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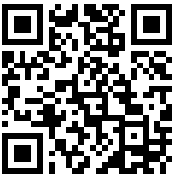

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THE EMPLOYMENT OF ROYAL ENGINEERS ON MANŒUVRES.

THE following extracts from the diaries of the C.R.E.'s and Field Companies during the recent manœuvres have been kindly communicated by the Inspector of Royal Engineers and give some idea of the work on which the Engineers were employed :—

(1).

EXTRACTS FROM THE DIARY OF THE C.R.E., 2ND DIVISION.

SEPTEMBER.

Monday, 13th.—Water supply and approaches to camp.

Tuesday, 14th.—Found bivouacs for the Division, in conjunction with the Staff, at Charlbury. Investigated water and water supply. Reported on facilities for dealing with supplies at night at the railway station.

Wednesday, 15th.—Reconnoitred position during the fight. Examined and reported on water supply facilities at Kingham, and also on those at Milton-under-Wychwood for night bivouac.

Thursday, 16th.—Water supply and approaches to camp at Witney.

Friday, 17th.—Attended Conference, Burford.

Saturday, 18th.—Improved approaches to camp.

Sunday, 19th.—G.O.C.-in-C. inspected camp. Made reconnaissance of river Thames for bridging in the afternoon.

Monday, 20th.—New bridge destroyed by enemy. Got up half 5th (Field) Company, 1 pontoon, and 1 trestle wagon to repair it at 8.18 a.m.; repaired by 8.38 a.m. Made pontoon bridge at Stanlake; ready at 8.50 a.m. Arranged water supply for bivouac same night.

Tuesday, 21st.—With G.O.C. mostly. Gave orders to companies.

Wednesday, 22nd.— Do. Do.

Thursday, 23rd.—Attended Conference at Faringdon.

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(2).

EXTRACTS FROM THE DIARY OF THE O.C. 5TH (FIELD) COMPANY, R.E.

SEPTEMBER.

Tuesday, 14th.—With Guards Brigade.

Wednesday, 15th.—Escort to guns and ready to entrench position when captured, but attack unsuccessful.

Monday, 20th.—Attached to Guards Brigade to assist in forcing river. Made a bridge and used spare boats as ferry. Repaired demolished brick bridge.

Tuesday, 21st.—Attached to 6th Brigade. Entrenched Sands Farm Hill on left flank and placed two farms in state of defence.

Wednesday, 22nd.—Attached to Guards Brigade. One section with advanced guard. Assisted to entrench.

(3).

EXTRACTS FROM THE DIARY OF THE 11TH (FIELD) COMPANY, R.E.

SEPTEMBER.

Wednesday, 15th.—Supported attack and assisted in capturing a locality and resisting counter-attack. Placed churchyard in state of defence.

Monday, 20th.—Attached to Infantry Brigade. Ordered to throw bridge. Order cancelled and ordered to join 5th Brigade. Assisted in attack on Cromwell's Battery, with a view to entrenching position when captured. Marched 31 miles and delivered an assault.

Tuesday, 21st.—Entrenched locality to repel counter-attack.

Wednesday, 22nd.—Owing to a misunderstanding, the company was in rear when urgently required to fortify a locality; made a forced march, but too late to do much good. Retired with the defeated infantry and prepared bridges for destruction to cover retreat.

(4).

EXTRACTS FROM DIARY OF THE C.R.E., 3RD DIVISION.

SEPTEMBER.

Friday, 3rd.—At Charlton Park.—Accompanied the Major-General in charge of Administration and C.E., Eastern Command, on their inspection of concentration and dispersion camps at Buscot, Coleshill, Charlton Park, Wootton Bassett, and Swindon Coate. Ordered to make arrangements for water supply of two bivouac areas near Wootton Bassett.

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Saturday, 4th.—Proceeded to reconnoitre the above bivouac areas with O.C. 57th Company, and handed over to him the making of the necessary arrangements. Reported to Colonel, General Staff, 3rd Division, at Sutton Benger, at 6 p.m.

Sunday, 5th.—Visited site of camp at Tetbury with O.C. 57th Company.

Monday, 6th.—Acted as C.R.E., Brown Force, under Brig.-General Mitford. 56th Company in the advance guard, half 57th with main body. Under verbal order from the Brigadier, I was proceeding to reconnoitre the Brinkworth Brook in the direction pointed out by him, to find a suitable place for a pontoon bridge, when the "Cease Fire" sounded. O.C. 56th Company was, by my order, reconnoitring for the same purpose on my right, so as to save time. Bridging equipment for both companies was available.

Tuesday, 7th.—Acted as C.R.E., Brown Force. Ordered to improve communication between centre and right sections of outpost line, half 57th Company, R.E., being available for work. This necessitated a bridge of 4 bays (1 pontoon, 2 trestles) over the river Avon, S.W. of the Malmesbury-Little Somerford road, east of Burton Hill. The existing brick bridge, 200 yards S.E. of the site selected for the temporary bridge, appeared to be unsafe for guns, but available for infantry and light carts. The exact site selected was where the bend of the river runs close to the railway, just north of fork in the stream. The bridge was commenced at 9.30, as ordered, but only 18 R.E. being available for work, the bridge was not completed when we had to stand to arms, and fall back fighting to Burton Hill.

Wednesday, 8th.—Acted as C.R.E., White Force, with half 57th Company. The half-company marched in the vanguard. No work was required to be done during the advance. On learning that the G.O.C. had decided to retire, I enquired the direction of the retirement and asked whether I should start cutting gaps in the hedges (where no convenient gates existed) to facilitate the movement. G.O.C. informed me that he intended to retire N.W. from the Rookery, past Worthy Hill Farm, on Stonehill Wood. The half-company, R.E., started on this work, but were obliged to desist, owing to an outflanking movement by the Cameron Highlanders along the road north of Somerford Common. At this moment I learnt that the G.O.C. had given up his intended line of retreat, and was moving instead on Charlton *viâ* Garsdon. The half-company packed up their tools and got away without coming under fire. One officer and 8 men of this half-company worked at Tetbury Camp.

Thursday, 9th.—The 3rd Division united fought against a skeleton enemy; half 57th Company was present with the Division. Half 57th Company moved from Tockenham Park to Swindon (Coate) for work. Half 56th was included in the skeleton force represent-

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ing 1 company; half 56th was at work preparing a supply depôt at Chippenham. The half 57th Company followed the attack of the 7th Infantry Brigade, and on reaching the top of the slopes leading down to brook running east of the village of Stanton St. Quinton, started to prepare this ground for defence in the event of our attack being driven back. Only 16 R.E. being present, it was not possible to do more than start the construction of two short lengths of fire trenches enfilading the road from Stanton St. Quinton. Application for a fatigue party of half-battalion was made to the Colonel, General Staff, 3rd Division, but a reply was received that it could not be made available until the village had been taken. The high ground east of the brook would therefore not have been prepared for defence in time to stem a counter-attack, had one been successfully delivered on the troops who carried out the assault.

Friday, 10th.—Half 57th Company working at Swindon Coate, concentration camp. The Division fought a marked enemy. Half 57th Company, R.E., followed attack of 7th Brigade, in case a bridge over the Gauze Brook was required. A brick bridge was found on the right flank of the brigade, and used by it and the 8th Brigade. It proved just strong enough to carry the batteries which had to cross it, but mortar fell out each time, and it was very near to giving way. The 56th Company marched on the high road N. of Corston. The O.C. 56th Company accompanied the Brigadier, 8th Brigade, in case it proved necessary to call on the company to bridge the Gauze Brook.

Saturday, 11th.—Work on Camps Malmesbury and Tetbury.

Sunday, 12th.— Ditto.

Monday, 13th.—Marched to Corsham with 56th and half 57th Company. Half 57th Company marched out with 7th Brigade to Calne.

Tuesday, 14th.—56th Company with advance guard with 8th Brigade. Eventually the 1½ companies supported attack of this brigade on the enemy's position near Wootton Bassett, but no R.E. work was required.

Wednesday, 15th.—The companies were ordered to accompany the attacking brigade in case the bridges over the canal at ·333 and E, Great Western Railway, were destroyed, but they were found intact. In the subsequent advance the 7th Brigade were stopped by finding the bridges over the river Ray and canal at Common Platt destroyed. The 57th Company was ordered up to repair them. I rode forward to inspect damage, and found fords for infantry close to bridges. The bridges would have taken 1½ hours to repair with material available on the spot.

Thursday, 16th.—The companies marched for Shrivenham in rear of the 9th Brigade. Before they reached that place they received the following orders:—The 56th were to go to Highworth, to join

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there the expected reinforcements of two skeleton brigades, and move with them to Coleshill, where they were to assist one of these brigades to entrench a position. The 57th Company was ordered to follow the 9th Brigade to Fernham, and be ready to entrench the position at British Village when captured by the 7th Brigade. O.C. 56th Company was directed to join G.O.C. 7th Brigade at Longcot at once. Unfortunately the O.C. 57th Company mistook the road and followed the 56th from west of Shrivenham towards Highworth. On discovering his error he marched for Fernham, joining the 9th Brigade in their attack on this village. Lieut. Gowlland was in command, the O.C. having ridden on to join the G.O.C. 7th Brigade, who were on the right flank. The company assisted to prepare Fernham for defence when captured, and took part in the fighting. The 57th Company on this day marched 30 miles.

Monday, 20th.—One section 56th Company with 9th Brigade at Wootton Bassett. One section 56th Company marched with 8th Brigade and rejoined Company Headquarters in the evening. 57th Company marched at head of vanguard, and put up four troughs and pumps in a side road 2 miles short of Purton Station to water horses at the breakfast halt. Later in the day the 57th Company were ordered to make a bridge between Inglesham and Dudgrove Farm, it being supposed that the Division was about to bivouac north of the river between Lechlade and Freshford, and a bridge between these places was required. O.C. 56th Company proceeded to reconnoitre the bridges from Dudgrove Farm onwards to complete this communication. Pontoons just unloaded when Division was ordered to advance to Little Faringdon, where both companies bivouacked after assisting 7th Brigade to entrench a position just as night closed in.

Tuesday, 21st.—Orders received 12.30 a.m. to be at Langford at 4.30, to place it in a state of defence, were cancelled at 2 a.m., and operations were postponed till 8 a.m. Companies reached Langford at 9.30 a.m., having followed the 7th and 8th Infantry Brigades. Working party of two companies Leinster Regiment assisted. Very simple job, stone walls and sunken fences existing all round. Pontoons were ordered to Inglesham, as not being likely to be required. On Clanfield being taken, R.E. and pontoons were ordered up in case bridges at Redcot were found destroyed. They were however found intact, and the whole Division marched across, moving south, a rear guard being left to guard the bridges while the R.E. prepared them for demolition. The G.O.C. rear guard ordered them to be blown up at 6 p.m., or earlier if the enemy advanced against them in pursuit from the north.

Wednesday, 22nd.—The two R.E. companies advanced in rear of

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8th Brigade, but halted ½ mile west of Watchfield. Officers were sent to reconnoitre the river Cole west of Stallpits Farm, in case it were necessary for the 7th Brigade on our right flank to retire. Their reports reached me at about noon, but by that time all idea of retirement had been given up. No further orders were given by the G.O.C. 3rd Division for the use of the R.E., but the G.O.C. 7th Brigade sent back the O.C. 56th Company to ask him to blow bridges on his outer flank. A section was sent to do this.

(5).

EXTRACTS FROM THE DIARY OF THE O.C. 56TH (FIELD) COMPANY, R.E.

SEPTEMBER.

Friday, 3rd.—Finished butchery. Completed washing benches and fixed screens, completing washing place. Sorting timber for cooking shelters.

Saturday, 4th.—Erecting cooking shelters for the brigade. Took up pumps and returned them to 57th Company, R.E. Strengthened culvert for traction engines.

Monday, 6th.—Operations.—Marched off 6.40 a.m. Wet in the morning. With advanced guard. Made gaps through two hedges. Returned to camp at 4.50 p.m. Erected cooking shelter for A.S.C.

Tuesday, 7th.—Divisional Training.—Marched with advanced guard 6.30 a.m. to Little Somerford. Three pontoons and trestle wagons, 2 double tool carts, 2 forage carts, and 2 pack horses. Commenced to put a bridge across near Hill, about ¾ mile west of X roads, Little Somerford, about 11 a.m., span 53′. Decided to take raft, with requisite material aboard, about ¼ mile up stream to a more favourable site, and had nearly reached the position when "Stand Fast" sounded—12.30 p.m. Reached camp at 4.30 p.m.

Wednesday, 8th.—Marched with the brigade at 6.30 a.m. Rendezvous, Dauntsey Green. No. 1 Section cut one large gap, 6′, and sixteen 3′ gaps in hedges to allow infantry to pass through in vicinity of the Rookery, about 1½ miles N. of Brinkwater. Vehicles with the company as on 7th. No. 1 Section returned at 5.30 p.m. Remainder at 4.30 p.m.

Thursday, 9th.—No. 1 Section did not go on operations, but proceeded to A.S.C. Supply Depôt for work (Chippenham). (1). Made 10′ breach in wall for entrance to camp ground. (2). Removed wooden fence 10r another gateway and levelled bank. (3). Erected a meat store, framework for. (4). Erected a latrine for N.C.O.'s and men, 7 seats, and 1 for officers. Erected cookhouse shelter, M.T.

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Camp. No. 2 marched with brigades at 7.10 a.m. Rendezvous, Stanton St. Quinton. Entangling edge of wood with barbed wire. Putting houses in state of defence, creating obstacles, and clearing field of fire by blowing down and felling trees (theory). Demolishing walls to erect sangars. Putting church in state of defence. Also took part with infantry in defence of village at latter part of operations.

Monday, 13th.—No. 1 Section paraded at 7.15 a.m. and marched to Corsham to prepare camp there. Laid down three horse troughs and pumps. Prepared two washing places for troops. No. 2 Section removed tanks, water fittings, and benches from Hardenhuish to M.T. Camp, Chippenham. Returned fittings to contractor. Took down cookhouse shelters at Hardenhuish Camp and stacked material at M.T. Camp. Erected one cookhouse shelter at Supply Depôt. Cleared up camp of 56th Company, and marched for Corsham about 6 p.m., arriving there about 7.40 p.m. 2nd Lieut. Smith-Rewse and 8 other ranks proceeded to Calne at 7.15 a.m., to make arrangements for watering there, laying down three horse troughs and two pumps, rejoining Hardenhuish on completion.

Thursday, 16th.—Leaving bivouacs standing and pontoons in camp, company marched off at 6.40 a.m., weather very wet, to Coleshill *viâ* Shrivenham. Placed houses in state of defence, also walls and hedges (theory), and remained in village until operations ceased. Signallers formed a communication station. Returned to Moredon Camp *viâ* Highworth at 5.30 p.m. Pitched tents. Distance marched, 24 miles.

Friday, 17th.—Lieut. Norton and 9 other ranks (No. 1 Squad) proceeded to Wootton Bassett for work there, marching at 7 a.m., taking No. 1 forage cart. Remainder of company marched at 7 a.m. for Charlton Park *viâ* Brinkworth, with 57th Company, R.E. Arrived 12.45 p.m. Pontoons, under 2nd Lieut. Pearson, marched about 9.40 a.m. by straight road. Arrived about 1.30 p.m. Tents arrived 6.30 p.m. Pitched camp. Distance marched, about 14½ miles.

Monday, 20th.—(*Headquarters and No. 2 Squad*).—Marched 3.55 a.m. *viâ* Garsdon. Halted to water at a stream E. of The Manor. Marched on *viâ* Purton, Smithy, Blunsdon St. Andrew, Highworth (reached 11.25 a.m.), to Upper Inglesham, 12.20 p.m. Watered horses and started to make tea for men. Ordered to close up on rest of Division, and moved up about 800 yards, 1.15 p.m. At 3 p.m. O.C. company sent to reconnoitre bridges over canal and river Coln, near Dudgrove Farm. At 4.30 p.m. company marched on through Lechlade. Halted in a field N. of Little Faringdon, whilst a defensive position was reconnoitred. At 7.15 p.m. ordered to bivouac in same field, about 150 yards from where wagons were halted. Placed Langford Downs Farm and a cottage in state of defence (theoretical), and made 6 ramps for crossing a deep ditch (practical).

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Entangled a hedge with wire from a fence (theoretical); 2 hours' work. 2nd line transport arrived, 1.15 a.m., on 21st. Distance, 26 miles. Weather fine.

No. 2 Section.—Marched *viâ* Castle Eaton—Hannington Bridge—Upper Inglesham. One officer reconnoitred positions for bridging river and canal E. of Kempsford. Placed Hannington Bridge in a state of defence (1.40 p.m.—4.30 p.m.). Marched back to Upper Inglesham and on to Lechlade. Rejoined Headquarters 7 p.m. Distance marched, 25 miles.

Monday, 20th.—(*No. 1 Squad*).—Marched 4.55 a.m., in advance guard of 9th Brigade, through Hook, Lydiard Green, Common Platt, Rodbourne Cheney, Upper Stratton, Stanton Fitzwarren, Highworth, Coleshill; rested in a field N. of Coleshill Church until 11 a.m.; watered horses from village pump. Marched to Broad Leaze Farm; O.C. ordered to report on water for the bivouac S. of Buscot. Marched at 2 p.m. to Badbury Hill across country on N. side. Remained on top of Badbury Hill till 7.40 p.m., when orders were received to bivouac where the section was then.

Tuesday, 21st.—(*Headquarters, No. 2 Section, and No. 2 Squad*).—At 9 a.m. received orders to proceed to Langford. On arrival there, ordered to place S.E. end of village in a state of defence (theoretical), with help of two companies, Leinster Regiment. At 11.45 a.m. received orders to march *viâ* Bate's Land Farm to Clanfield. *En route* received orders to march on to Radcot. Between Clanfield and Radcot road blocked, and in spite of urgent orders to push through to Radcot, was unable to pass more than three units. Arrived Radcot 2.20 p.m.; halted in a field, and cooked whilst bridge was prepared for demolition and another was demolished (theoretical). At 4.15 p.m. received orders to get on to road S. of the bridges, ready to move towards Faringdon. Found one side of road occupied by guns and vehicles, so in moving blocked road. Finally got vehicles scattered off the road at odd intervals, so as to clear road. Reached a farm ½ mile N. of Coleshill 9.30 p.m., and bivouacked in farm buildings. Distance, 19½ miles. Weather fine up to 7.30 p.m.; then rain.

Wednesday, 22nd.—Ready to march 7.45 a.m. Moved on to Highworth road and waited for remainder of Division. No. 1 Squad rejoined 8.50 a.m. Marched 10.30 a.m., following the Heavy Battery *viâ* Friars Hill to a point ½ mile N.W. of Watchfield. two officers sent to reconnoitre crossings over river Cole for infantry, in case of retreat. No. 1 Section sent at 3 p.m. to destroy canal bridges S. of Shrivenham, with 7th Infantry Brigade. Distance, 9 miles. Weather fine.

No. 1 Squad.—Marched at 8 a.m.; rejoined the company at Coleshill village at 8.50 a.m.

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(6).

Extracts from the Diary of the O.C. 57th (Field) Company, R.E.

September.

Tuesday, 7th.—Reconnoitred for bridge sites and made bridges. Bridge attacked during construction.

Wednesday, 8th.—With advanced guard cutting gaps through hedges. Improved roads for possible retirement of guns, etc.

Thursday, 9th.—Placing locality in state of defence. With rear guard. Arranged for blocking roads by felling trees. Attacked by enemy during operation. Ordered to reconnoitre a position for entrenching; applied for half-battalion working party, but this could not be provided in time to do good work before enemy captured position. Prepared locality for defence.

Friday, 10th.—Attached to Infantry Brigade. Bridge making and assisting in advance.

Wednesday, 15th.—Attached to brigade. Reconnoitred bridge over canal for repair if destroyed. Supported brigade in the attack.

Thursday, 16th.—With brigade. Supported attack with a view to entrenching position when captured. Fortified localities during engagement.

Monday, 20th.—Reconnoitred river for construction of bridges. Improved communication on position.

Tuesday, 21st.—Placed village in state of defence. Prepared bridges for destruction.

Wednesday, 22nd.—With brigade. Reconnoitred river.

(7).

Extracts from Diary of the C.R.E., 4th Division.

September.

Wednesday, 15th.—The Division was covering the retirement eastward of the main Blue Force. O.C. Divisional Engineers advised upon and inspected preparation of the position at Blunsdon St. Andrew; directed the demolition of several bridges over river Ray and canal; accompanied umpire at his inspection of the bridges after "demolition," and arranged the water supply at Stanton bivouac ground.

Thursday, 16th.—The Division took up a position S. of Faringdon, facing S.W.; C.R.E. accompanied G.O.C. at his reconnaissance, and at Conference, when he directed the disposition of the Division; conferred with G.O.C. 12th Infantry Brigade regarding his line of

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defence; advised as to the employment of the R.E. companies; generally inspected and discussed the dispositions; directed water supply for Uffington Camp, which the Division reached.

Monday, 20th.—Marched with Headquarters from Uffington bivouac to Faringdon; first line taken up from Buckland to Buscot. Received orders at 2.50 p.m. that bridges would probably be required across the Thames near "Lock Inn" Bridge (S.E. of Lechlade), which had been destroyed; ordered Field Companies and Bridging Train forward to a preparatory position; the bridges were not required; I reconnoitred positions for these bridges, and for others near Philip's Farm, and found the sites favourable.

Tuesday, 21st.—Before dawn ordered an officer, 9th Company, with a section, to report to G.O.C. 12th Infantry Brigade, with a view to preparing Radcot bridges for demolition before daylight. Orders arrived about 3 a.m.—after all had turned out—to "Stand Fast" till 8 a.m. I ordered R.E. to be ready to bridge near Philip's Farm at 8; the two medium bridges were ready by 8.30; span only 50′. The R.E. being alone and the situation unsafe, at noon I ordered Bridging Train to Faringdon, and the two companies to take a covered position, with a view either to advancing to dismantle or to retiring (and abandoning the bridges), the G.O.C. approving.

(8).

EXTRACTS FROM THE DIARY OF THE O.C. 7TH (FIELD) COMPANY, R.E.

AUGUST.

Tuesday, 31st.—Part of skeleton force occupying a position. The company assisted in entrenching a position, to be occupied by the reserve in the event of the enemy attempting to turn the right. Tool cart used as dummy gun. Owing to dearth of scouts, 2 officers and 2 mounted N.C.O.'s were sent out scouting.

SEPTEMBER.

Friday, 3rd.—Company behind general reserve until 5 p.m., when ordered to entrench rallying position.

Monday, 6th.—Part of skeleton force. Especially employed in erecting an imaginary work on the left flank.

Tuesday, 7th.—Assisted in attack, then ordered to entrench rallying point.

Friday, 10th.—Reconnoitring, communication, and constructing of bridge to enable artillery to get to the front.

Tuesday, 14th.—Section with advanced guard. Barricaded a street.

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Wednesday, 15th.—One officer ordered to discuss with G.O.C. Brigade the entrenching of the position. Another to reconnoitre bridges over railway, canal, and river, and then with detachment prepared bridges for demolition. Ten bridges prepared. All but two were destroyed.

Thursday, 16th.—Attached to an Infantry Brigade; 2 officers of the company rode on to reconnoitre position. Assisted in preparation for defence of houses and gardens ¼ mile E. of Furze Hill, and clearing foreground, chiefly hedges; when position was attacked the company assisted in the defence.

Saturday, 18th.—Officer reconnoitred river Thames.

Monday, 20th.—Throwing bridges over Thames and making bridge-heads.

Wednesday, 22nd.—With Infantry Brigade to entrench a position.

(9).

EXTRACTS FROM THE DIARY OF THE O.C. 9TH COMPANY, R.E.

AUGUST.

Monday, 30th.—Churn Camp.—Went with two companies of the Queen's to take up a position covering sunk road, Bower Farm-Aldworth and Aldworth-Streatley road, from attack from Compton. This was the left flank of the main position. Position was entrenched at intervals. No attack took place.

SEPTEMBER.

Friday, 3rd.—Churn Camp.—Marched with 7th (Field) Company, R.E., to a point on the East Ilsley-Compton road to resume the operations left off on Thursday. At 3.30 p.m. moved off behind the reserve brigade through East Ilsley. When ½ mile east of West Ilsley the two companies were pushed forward to entrench a position covering the West Ilsley-Chilton road east of Cow Down. Trenches were taped out, but no excavation done.

Monday, 6th.—Marched to rendezvous on Harwell-West Hagbourne road. An attack was made by 4th Division against a skeleton enemy who held the Ridgeway. As soon as the infantry had gained Hagbourne Hill the 9th Company, R.E., was brought up to entrench it. Half-company, R.E., entrenched this point; the other half-company, R.E., was pushed on behind the firing line, and as soon as Chilton was secured by the infantry, the latter half-company placed Chilton in a state of defence. This was completed by 1.30 p.m. The company then advanced eastward by South Row, and watched the infantry attack on the Ridgeway from under cover. "Cease Fire" sounded at 2 p.m.

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Tuesday, 7th.—Remained at rendezvous till 12 noon, while infantry advanced through Compton on the high ground, Lowbury Hill-Bower Farm-Aldworth. At noon advanced to Cheseridge Farm. After a short halt here, while a rallying position was selected on the high ground west of Compton, the 9th (Field) Company moved to Perborough Castle and taped out trenches, following the line of the old Roman entrenchments, and assisted infantry in selecting positions for Maxims, etc.

Friday, 10th.—The 9th (Field) Company, after picking up pumps and troughs, proceeded to the rendezvous; the G.O.C. 10th Division intended to attack a skeleton enemy who held a strong position on the Faringdon ridge. Two officers of the company went out in front to reconnoitre the ground, as the country being very enclosed and intersected by streams, it was anticipated that the attack would require some assistance from the R.E. in the form of bridging, etc. The 11th Infantry Brigade firing line had secured Sanos Farm at 11.15 a.m. The 9th (Field) Company, who advanced close behind the firing line, placed this farm in a state of defence as a rallying point and to cover a brigade of R.F.A., who had taken up a position 500 yards S.W. of the farm. Sanos Farm was in a fair state of defence by 12.45 p.m. At 1 p.m. the "Stand Fast" sounded, and the 9th (Field) Company marched 13½ miles to Coate, tool carts going on in front with an officer to put up pumps and troughs.

Tuesday, 14th.—After picking up troughs and pumps and returning tents, the company proceeded to the rendezvous at the inn on the Coate-Swindon road, ¼ mile west of Coate, arriving there at 8 a.m. Half-company was with the vanguard; the other half-company was at the head of the main body of the 11th Infantry Brigade. The 11th Infantry Brigade proceeded along the Swindon-Wootton Bassett-Malmesbury road. When the vanguard reached the point 355 near the junction of the roads 1½ miles N.E. of Brinkworth, they were ordered to retire to the cross roads N.E. of Wootton Bassett, where the half-company with the main body had already commenced putting the buildings at the cross roads in a state of defence. At 11.45 a.m. the buildings at the cross roads were in a fair state of defence and being still improved. At 12.45 p.m. these buildings were attacked by two companies of the enemy's infantry; the 9th (Field) Company, holding the buildings, beat them off. The attack was reinforced to 1½ battalions, which were held up for more than 1 hour by the 9th (Field) Company, who were not reinforced during the whole of the time. At 1.10 p.m. a message was sent to the G.O.C. 4th Infantry Brigade, but after that time no more messages could be got through, owing to the post being completely surrounded by the enemy. No artillery was employed by the enemy in the attack of this post. At 3 p.m. the "Stand Fast," and the 11th Infantry Brigade and 7th and 9th (Field) Companies bivouacked in the fields

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close to cross roads N.E. of Wootton Bassett; the companies put up pumps and troughs here, and at Ballards Ash.

Wednesday, 15th.—The 4th Division took up a position on the ridge above Blunsden St. Andrew. Half-company went off early to destroy the bridges over the river Thames at Castle Eaton and Hannington. Of the remaining two sections, one proceeded to Blunsden Hill and the Abbey to assist in the preparation for its defence. The other section proceeded to Pen Hill to assist in preparation for defence of the left flank. Pen Hill was a very strong post and the key to the whole position, as from here a flanking fire could be brought to bear along the whole front of the main position. Owing to the destruction by the 7th (Field) Company of the river bridges between Blunsden Station and Swindon, the attack was greatly delayed and did not commence till 3 p.m. At 4 p.m., before the attack had been thoroughly launched, the "Stand Fast" sounded. The 9th (Field) Company bivouacked at Stanton Fitzwarren, putting up pumps and troughs there, and at Hampton. Second line transport did not arrive till 11 p.m.

Thursday, 16th.—The 9th (Field) Company paraded at 6 a.m. and marched *viâ* Highworth to Badbury Hill. The 4th Division took up a strong position on the line Badbury Hill-Great Coxwell. The 9th (Field) Company were with the 12th Infantry Brigade, and were employed strengthening the position Badbury Hill-Great Coxwell. Monks Barn and Farm were placed in a state of defence.

Saturday and Sunday, 18th and 19th.—Officers were employed reconnoitring bridges, fords, etc., over the rivers Thames and Isis.

Monday, 20th.—The Cumnor force, being in a very precarious position, bivouacked beside the road on Sunday night, in order to move off the moment hostilities commenced at 4 a.m. on Monday. Charges were prepared on ladders between 6 p.m. 18th and 4 a.m. 19th for the destruction of Newbridge, and large trees were loaded up on timber wagons in the brickfield, ready to run out on to road to block it in early morning. The men and charges for the destruction of Newbridge were carried down to the spot on R.F.A. wagons, and the bridge was destroyed at 5.35 a.m. Owing to the strength of the bridge and the necessity for rapid and immediate destruction, the gap made was not very large, but was judged by the umpires to be sufficient to delay the enemy 1½ hours. During the march west 1 single tool cart, and with 4 sappers mounted on it, followed in rear of the flank guard and main column, blocking the road at intervals by felling trees across it or in any available way. The Cumnor force successfully effected a junction with the force on the Faringdon position. The remainder of the company placed Northfield Farm in a state of defence, and later, when joined by the Cumnor section, the whole company proceeded south of Philips Farm, placing the buildings in a state of defence and holding themselves ready to

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bridge the river at or near Philips Farm. At 9.30 p.m. one section was ordered to proceed to Headquarters, 12th Infantry Brigade, at Hattens Farm and to prepare for demolition Radcot Bridge as soon as it was taken by the Blue Force. This bridge, after an armistice of 4 hours, was taken, and the preparation for demolition completed by 12 noon on 20th September. The actual demolition was undertaken by the O.C. Divisional Engineers, 3rd Division.

Tuesday, 21st.—The company, less one section at Radcot Bridge, proceeded to Philips Farm and bridged the river Thames with pontoons, and took up a position to defend the bridge-head. The bridge was only used by a few cavalry scouts.

Wednesday, 22nd.—The 9th (Field) Company was attached to 12th Infantry Brigade, and marched out, with one section in the advance guard, to take up a position in Eastrop-Friars Hill. The company strengthened the right flank by putting in a state of defence a hedge which had a good field of fire over ground which was dead to the remainder of the position, and also fortified the cross roads at Friars' Hill as a rallying point, with stone sangars made of road metal. The company then accompanied a counter-attack made by the 11th Infantry Brigade.

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THE COMITIA CENTURIATA OF SERVIUS TULLIUS, CIRCA 510 B.C.

By COLONEL O. E. RUCK, LATE R.E.

THIS Assembly, far reaching in its political results on the military destinies of the Roman People, differed from its prototype, the Comitia Curiata, instituted by Romulus, Circa 753 B.C., in that, in the latter, only those Roman Citizens who lived within the City or were included in some Curio or Urban parish had the right to vote.[1] An Assembly of the whole Roman People to give their vote about anything was termed a Comitia, but when only a part were assembled it was called a Consilium.[2]

In the Comitia Centuriata all important business which came under the power of the People was transacted, laws were passed, and more particularly the decisions given as to the declaration of war, or the making of peace.

A third Comitia, termed the Tributa, was introduced at the time of the trial of Coriolanus, B.C. 490, and could be held without the authority of the Senate. It dealt with less important matters, such as the creation of magistrates, the election of priests, the making of minor laws, and the holding of trials—those for Capital offences being omitted.[3] In the Comitia Tributa the votes of all citizens were of equal force, and this form of committee was seldom attended by the Patricians; moreover, all Roman Citizens might vote whether they lived in Rome or in the country.[4]

Servius Tullius, who instituted the Comitia Centuriata, was the Sixth King of Rome, the last but one of the seven Kings who reigned during the first 263 years of the City. All of these—with the exception of Tarquinius, the last—so reigned, that they have been justly considered to have laid the foundations of Roman greatness.[5]

To Servius Tullius has been ascribed the credit for founding a long-sighted political organization, based on firm bed-rock principles. Suited to the times, it tended to produce a large reserve of National Power, which ultimately led the Roman Republican Armies to a victorious zenith of success during the next three centuries of time, by giving the preponderating authority to the most responsible citizens, or those who held the largest stake in their country's interest.

Servius Tullius was however not in possession of any absolute or hereditary power, but, by the nature of the constitution, limited and

[1] Livy, IX., 38. [2] A. Gell., XV., 27. [3] Livy, II., 56. [4] Livy, XLV., 15. [5] Livy, II., 1.

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elective only ; neither could he declare war nor make peace without either the concurrence of the Senate, or by the desire of the representatives of the People.[1] As King of Rome Servius was also a priest, thereby possessing the chief direction of sacred things, as was the custom in Greece. To how great an extent the ancient Romans respected religion and its ministers is well known. The Patrician Augurs also had to be consulted by taking the Auspices before a Comitia Centuriata could be held.[2]

The governing principle of the Centuriata was that the People, divided into the Centuries of their Classes, gave their votes; and what a majority of the Centuries determined (quod plures Centuriæ jussissent) was held to be ratified.

This Comitia—held according to the Census instituted by Servius Tullius—virtually consisted of a numbering of the People, together with a Valuation of their fortunes (æstimatio). These estimates had to be made on oath by the Roman Citizens themselves, both in town and country, and if found to be untrue, their goods were confiscated, and they themselves were scourged and sold as slaves, as persons who had shown themselves as unworthy of liberty.[3]

Thus, according to the value of their personal estates, Servius Tullius divided all the Citizens into six classes, and each class into a certain number of Centuries, both for service and for voting power.

In the article by Colonel Hickson, in the August *R.E. Journal*, he quotes Mommsen as stating "the body of men liable to serve was distributed according to the size of their portions of land into five classes," and Mommsen was right, as was to have been expected, for the sixth class comprehended all those who either had no estates, or were not worth so much as those of the fifth class.

The number of sixth class men was so great as to exceed that of any of the other classes, and yet they were only reckoned as one Century out of a total of 192 Centuries, or an almost negligible quantity in Voting Power.

The division by Centuries prevailed everywhere at Rome. The Infantry, Cavalry, Curiæ, and tribes were so divided, and so even was the land (centuærius ager).[4] At first a Century contained a hundred, but not so afterwards ; thus the numbers included in the Centuries of the different Classes was an elastic one after, and perhaps in, the time of Servius Tullius.

The First Class, or Class A, included all those who valued themselves in lands and effects as worth at least 100,000 asses, or pounds of brass, or at £7,750 a head.

This class figured up to 80 Centuries of foot—40 Centuries of young men and 40 of old men (seniorum);[5] to these were added

[1] Dionysius, II., 13. [2] Virgil, Æn., III., 80. [3] Cic. pro Cœcin., 34.
[4] Festus. [5] A. Gell., X., 28; Cic. de Senec., 17.

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18 Centuries of Equites, or the corps d'élite, 12 Centuries of which were created by Servius Tullius from the Chief Officers of State, specially selected as Knights of the Equestrian Order. These were chosen by the Senate and presented with a horse apiece at the public expense, together with a gold ring. The private fortune of each of the Eques was fixed at a minimum of 400 Sestertia, or £3,229 British.[1]

A great degree of splendour attached to the Equestrian Order, and they were held in much respect in Rome. Indeed, Cicero speaks of them as "Homines amplissimi, benetissimi, et ornamentissimi"; an extremely mobile corps, without saddles or stirrups, who every fifth year were Recognoscebantur or passed in review before the Censor, seated in his Curule chair as sited before the Capitol. Each Eques dismounted and led along his horse before the Censor's gaze (traducebant), and in this manner was inspected. If any Eques had perchance diminished his fortune, or even had neglected to take proper care of his horse, he was ordered by the Censor at once to sell the animal, and at the same time to consider himself removed from the roll of the Equestrian Order. Those of whom the Censor approved however were ordered to pass along (traducere) together with their horses.[2] Thus, with the Equites, the First Class—or Class A—were valued at 98 Centuries for Voting Power.

The Second Class (calare), Class B, consisted of 10 Centuries of young men (17—46 years of age), 10 Centuries of old men (seniorum), valued by themselves at a lump sum of £5,811 a head. To these were added 2 Centuries of artificers (Fabrum), such as carpenters, smiths, etc., to manage the engines of war, included by Livy in the First Class, or Classici.

It is however hard to imagine that these artificers were included in this aristocratic class, either in A or in B Class, but merely attached as useful; for it must be remembered that not only the mechanical arts, but also any kind of trade, was esteemed dishonourable amongst the ancient Romans. It seems more likely that these worthy men were the handy men on the rich men's estates, and would be more than useful in enabling the old men, who were told off to guard the City, to man their heavy guns of the Onager and Ballista type as Garrison Artillerymen, if such existed at the time referred to.

The Third Class, or Class C, were divided into 20 Centuries, who valued themselves at a sum of £3,875, or 50,000 pounds of brass, or 5,000 Drachmæ, in the Greek way of computing.

The Fourth Class, or Class D—20 Centuries—estate, £1,937 a head.[3]

The Fifth Class, E—30 Centuries—estate, 12,000 asses—£968. Amongst these were included the trumpeters, corneters, and blowers on the horn, divided into three Centuries.[4]

[1] Horat., ep. I., 1, 57; Plin., ep. I., 19. [2] Ovid., Trist., I., 89; Gell., IV., 20; Livy, XXIX., 37. [3] Dionysius. [4] Livy.

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The Great Sixth Class, or the vast majority, not mentioned by Mommsen, has already been alluded to as the innumerable and comparatively negligible remainder.

The number of classes above enumerated summed up to a total of 191 Centuries according to Livy, or 193 according to Dionysius. Each class, as mentioned by Mommsen, had arms peculiar to itself and a certain place when in battle array, according to the valuation of the fortunes of those composing it.

As the Roman Army in early times was usually drawn up in three lines, several rows deep, the Principes in front[1]—*i.e.*, until Cæsar's time, when the best trained and bravest men were chosen for this purpose, irrespective of birth or fortune, and contrary to ancient custom—the Equites would be found behind, a class of principal foot-soldiers, ready to be let loose on the enemy should a favourable opportunity arise, and in case of a temporary repulse to rally in rear.[2]

The Classici thus consisted of the First Class only,[3] Equites, and the A Class; all the rest were said to be Infra Classem. Hence classici auctores—the best authors.

Those of the lowest class, who had no fortune at all, were called Capite Censi, rated by the head, and those whose fortune was below a certain valuation, Proletarii.[4] "This properly was not reckoned a class, whence sometimes only five classes are mentioned."[5]

By the Centuriata the chief power was vested in the richest citizens, who composed the First Class, which, although least in numbers, consisted of more Centuries than all the rest put together; but they likewise bore the charges of peace and war (munia pacis et belli) in proportion.[6]

For as the votes at the Comitia, so likewise the quota of soldiers and taxes depended on the number of Centuries. Accordingly, the First Class—which consisted of 98, or, according to Livy, of 100 Centuries—furnished more men and money to the public service than all the rest of the State besides.

But they had likewise the chief influence at the National Assemblies by Centuries, for the following excellent reason. The Equites and the Centuries of the First Class, *i.e.*, the Classici, were called to give their votes *first*, and if they were unanimous, the matter was carried as well as ended. But, on the other hand, if not unanimous, then the Centuries of the next class were called in to help settlement, and so on, until a majority of Centuries had voted the same thing.

After the Census of the people was finished for the holding of the Curiata, an expiatory sacrifice was made by carrying a sow, a bull, and a sheep round the whole assembly, and then slaying them; and thus the people were said to be purified.[7]

[1] Sallust, Jug., 49; Cæsar, Bell. Germ., I., 19. [2] Livy, XXX., 33; Sallust. [3] A. Gell., VII., 13. [4] Gell., XVI., 10. [5] Livy, III., 30. [6] Livy, I., 43. [7] Virgil, Ecl., X., 55; Æn., VIII., 231; Plaut., Amph., II., 2, 144; Virgil, Æn., VI., 229.

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INTERNATIONAL AERONAUTICAL EXHIBITION, PARIS.

By LIEUTS. W. D. BEATTY AND A. D. DE R. MARTIN, R.E.

ALMOST all the better known types of heavier-than-air flying machines were collected together at the International Aeronautical Exhibition, which opened at Paris on September 25th, and the strides that have been made of late in the science of aviation were well demonstrated by the fact that each exhibitor—instead of being looked on as possibly a genius and certainly a madman—was booking orders for delivery of his machines to all parts of Europe.

The following article is intended to provide a short description of the various points of the different aeroplanes, for the benefit of those who, though interested in aviation, were unable to visit the Exhibition themselves.

The writers had the good fortune to visit the majority of the aeroplane factories near Paris last December, and were thus enabled to note the various improvements that have since been made in their design and construction. As regards design generally, there have been few new features introduced, if the Santos Dumont and Raoul Vendôme monoplanes and the Chauviére biplane are excepted.

The most noticeable alteration is in the chassis—that is, the part on which the aeroplane rests while on the ground. A year ago there were two types of chassis—the wooden skates of the Wright machine and the steel tube framework mounted on wheels of the Voisin and other types.

The skates alone offer obvious difficulties in starting, and the Wright machines are only able to start without their starting rail on very firm short turf. The steel chassis on wheels, on the other hand, frequently collapses on the shock of landing.

Now a combination of the two types is almost universal, long wooden skates with wheels mounted on them being provided. The machine is balanced so that it runs on the wheels when starting, while on landing the spring-mounted wheels give sufficiently to let the greater part of the shock be absorbed by the skates.

Pedal levers for control of the engine or the steering have come into use, and arrangements for controlling the engine are generally improved.

As regards construction, the workmanship in general shows marked improvement, and a high level of excellence has been attained. The Antoinette and Farman machines are most noticeable in this respect.

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Before giving a detailed description of the various types of aeroplanes exhibited, it may be as well to set down a few of the technical terms used in connection with the machines. The following is a glossary of those most commonly met with, viz. :—

(1). *Planes.*—The supporting surfaces of the machine.
(2). *Rudder.*—Used for steering to right or left.
(3). *The Elevator.*—Used for steering up or down.
(4). *Balancing Planes.*—Small movable planes fitted to enable the aviator to vary the resistance to flight of either side of the aeroplane, and so maintain it on an even keel laterally.
(5). *Aspect Ratio.*—The length of leading edge of plane divided by distance between leading edge and trailing edge, usually about = 5 for a biplane.
(6). *The Outrigger.*—A girder or other connection between the planes and the tail.
(7). *Propeller.*—Screw behind the planes.
(8). *Tractor.*—Screw in front of the planes.

ENGINES.

One of the features of the Exhibition is the large number of well-known motor firms who are exhibiting types of light engines for use on dirigibles and aeroplanes. Amongst these are Darracq, Clement Bayard, Panhard Levassor, Wolseley, De Dion, Fiat, etc. Water-cooled engines are in the majority, the radiators and frequently the water jackets being of copper. The Wolseley 180-H.P. engine for a dirigible attracted a considerable amount of attention.

The Green engine was the only English-made motor exhibited which was adapted for aeroplanes. Simplicity and accessibility have been largely attained in this engine. The 4-cylinder 50—60-H.P. model weighs about 225 lbs. and costs about £250.

The Gnome engine was fitted to Farman's machine. This engine was very successful at the Rheims meeting, but it appears doubtful whether it will have much of a vogue in the future, in view of its absolute inaccessibility when running.

MONOPLANES.

Blériot.—The small aeroplane, on which the crossing of the Channel was effected, had the place of honour in the centre of the hall at the Grand Palais. Marked and stained from its travels, it stood out from the highly varnished and polished machines surrounding it, its rudder scrawled all over with the signatures of the various reporters and others who had hurried to meet it on its landing at Dover. Several other machines of the Blériot type were also on view, including No. 20, a large machine with a 100-H.P. engine.

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Antoinette.—Two highly finished Antoinette machines were exhibited. One of them, fitted with a 100-H.P. 16-cylinder motor, is that on which M. Latham hopes to make some new speed records.

R.E.P.—M. Esnault Pelterie exhibits one of his red covered aeroplanes. These machines are of steel construction throughout and the workmanship is very good, but so far success has not attended them. The very small camber of the planes is noticeable.

Koechlin.—The Pischoff-Koechlin aeroplane has no elevator, the planes themselves being pivoted, so that their angle to the horizontal can be altered at the will of the aviator.

A.V.I.A.—This machine has a single elevator, with a double rudder, and two small fixed horizontal planes, all carried at the tail.

Hanriot.—Rather like the Blériot machine in appearance. The leading edge of the planes is very blunt. It has apparently no means of warping the planes, nor are balancing planes provided, so its lateral stability would appear doubtful.

Ganglier.—This machine has two propellers, chain driven, supported on brackets, one on each side of the outrigger, about midway between the planes and the tail. It was the only *propeller*-driven monoplane on show.

Lioré.—Two tractors, chain driven, are fitted to the front of the planes of this machine. It was the only monoplane so fitted. The trailing edges of the planes are hinged, so as to provide for lateral stability.

Grégoire Gyp.—As in the Koechlin monoplane, the planes are pivoted, so that an elevator is dispensed with. A small fixed vertical plane is fitted at the tail in addition to the rudder.

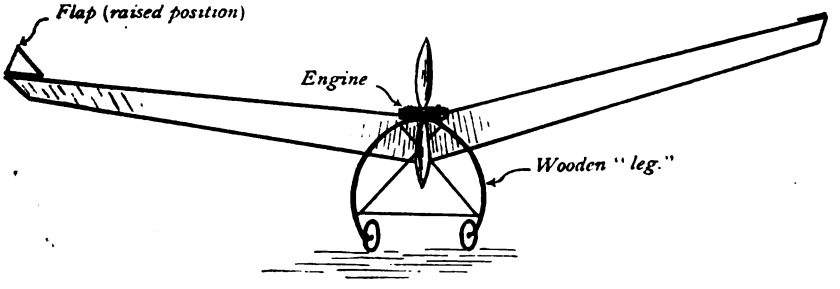

FIG. 1.—*Vendome Monoplane—Front View.*

Raoul Vendôme.—This is quite the most interesting of the lesser known monoplanes, as it embodies several distinctive features. Instead of warping the planes to secure lateral stability, it is fitted with small flaps at the front corners of the planes. In the normal position these lie close along the tops of the planes. If one side of the machine tips up, the flap on that side is raised, so bringing that edge down again by increasing the resistance. The outrigger, instead of being of girder form or boat shaped, is practically a trussed beam. The elevator is

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rather large and is curved to the same camber as the planes. It is placed above the rudder at the tail. The planes are set at a small dihedral angle, like those of the Antoinette monoplane. The chassis is also of an unusual type, consisting practically of two curved wooden legs with small wheels at the feet.

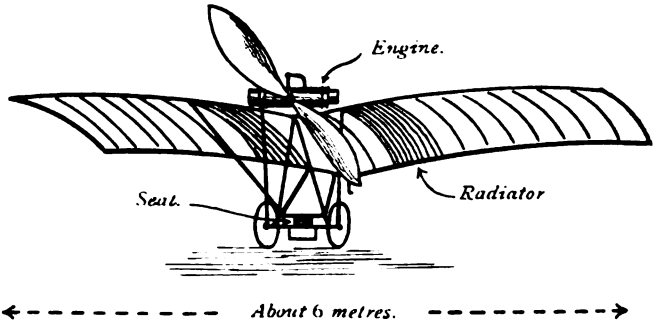

FIG. 2.—*Santos Dumont Monoplane—Front View.*

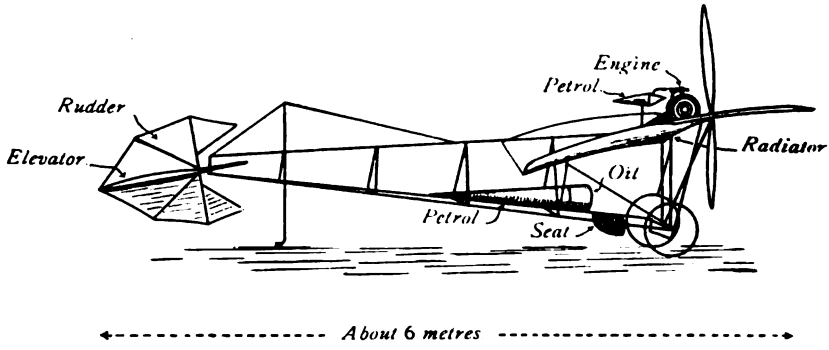

FIG. 3.—*Santos Dumont Monoplane—Side View.*

Santos Dumont.—The framework of this—the smallest serviceable aeroplane existing—is of bamboo and aluminium tubing. There is a joint just behind the planes at which the tail can be taken apart for convenience of transport. The planes are set at a small dihedral angle, and have a fairly large camber. The leading edge of the planes appears to be somewhat flexible, which is unusual. The supporting surface is only about $9\frac{1}{2}$ square metres. The elevator and rudder are rigidly attached to each other, and are connected to the tail by what is practically a universal joint.

A 2-cylinder 30-H.P. Darracq engine, water cooled, with forced lubrication and magneto ignition, is mounted at the point of the V formed by the planes, with the tractor directly connected to it. The aviator sits on a slung leather seat below the planes.

The machine is supported on two bicycle wheels, which are close beside the aviator, who, on landing, uses his hands as brakes to stop the aeroplane. A small skate supports the tail. The main petrol and

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oil reservoir, of conical shape, is placed directly behind the aviator's seat. An air pump, driven off the engine, maintains sufficient pressure in this reservoir to raise the petrol to the small expense tank above the engine. A rubber bulb, similar to that of a motor horn, is used for pumping up the petrol before starting the engine. The cooling water is pumped through radiators of very small copper tubing placed underneath the planes. The elevator is controlled by a lever on the right of the aviator, the rudder by a hand wheel on his left. The flexing of the planes is almost automatic. Steel wires attached to the extremities of the planes are fastened to a vertical lever fitted behind the aviator's seat. Over the end of this lever fits a small tube which is sewn onto the coat of the pilot. When the aeroplane tilts to one side, the instinctive movement of the aviator's body moves this lever, flexes the planes, and rights the machine.

A similar method of warping the planes is used on the Koechlin monoplane.

An accelerator pedal is fitted for controlling the throttle valve. Thus the pilot has both hands free for directing the aeroplane at the critical moment when he is changing the speed. M. Santos Dumont has not patented any of the features of this monoplane, as he wishes the public to have the full benefit of the results of his experiments.

Biplanes.

Wright.—The original aeroplane on which Wilbur Wright first appeared before the public in America and France was on view, and also No. 15, which was in use at Rheims. The rudder on the Wright machines is no longer used for steering in general. Turning is effected by the warping of the planes, the rudder coming into use for keeping the machine on its course when the planes are warped to overcome a lateral tilt.

Voisin.—Messrs. Voisin show one of their well-known machines. They still adhere to their system of vertical panels, which give good lateral stability in ordinary circumstances.

No means of obtaining lateral stability mechanically is fitted.

Clement Bayard.—In appearance this machine is very similar to Farman's. Balancing planes are attached to the end uprights, midway between the main planes. The tail consists of two fixed horizontal planes, with the vertical rudder between them. The elevator is carried in front of the main planes. The ends of the main and tail planes are rounded off, as in the Wright machine.

Fernandez.—The elevator is in front and nearly on a level with the top plane. The rudder and a small fixed horizontal plane are carried at the tail. The trailing edges of the planes can be flexed for lateral stability. The aspect ratio of this machine appears to be slightly larger than most of the other biplanes.

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Dutheil-Chalmers.—Very similar to the Clement Bayard, except that the elevator has two parallel planes, as in the Wright machine, and is very close to the main planes. The chassis—wheeled skates—appeared to be well designed.

Farman.—This machine is similar to those used by Mr. Henry Farman at Rheims and Berlin. It has been designed by him after considerable experience with Voisin biplanes. The vertical panels of the Voisin machines have been omitted and a double rudder fitted in the tail. For lateral stability parts of the trailing edges of the planes are hinged and used as balancing planes. The elevator is carried rather higher than in the Voisin machines, and is about the same distance in front of the planes that the tail is behind them.

A notable point in this machine is the chassis, which consists of two long wooden skates with a pair of small wheels mounted on each, and pivoted in a similar manner to the bogie of an engine. A Gnome motor is fitted to this machine *behind* the propeller. The finish of this aeroplane compared favourably with that of any other exhibit.

Chauviére.—Perhaps the most interesting exhibit, next to M. Santos Dumont's "Demoiselle," was the biplane—or as some termed it the "double monoplane"—shown by M. Chauviére, the manufacturer of the well-known "Intégrale" propellers. A very small machine with a triangular girder outrigger, it consists of a horizontal upper plane, and a lower plane placed behind the upper one, the halves of which are set at such an angle with each other that their ends almost reach the level of the ends of the upper plane, to which they are rigidly attached. The engine and tractor are mounted at the centre of the front of the upper plane, and the aviator's seat is just in front of the middle of the lower plane. The chassis consists of wheeled skates. The ends of the planes are easily flexed to obtain lateral stability. A small rudder and elevator are fixed at the end of the tail.

This arrangement of the planes is said to ensure good automatic lateral stability, and, as a type, the machine stands by itself in the show.

MISCELLANEOUS.

Messrs. De Dion Bouton exhibit a multiplane. This machine was not finished and appeared of very heavy construction. It did not seem to be a promising type.

Messrs. Vuitton show a helicopter. The lifting screws are of canvas stretched over a light wooden framework. This ensures lightness, but this type of screw has been proved to be very inefficient owing to its high skin friction.

Several model dirigibles and a large number of model aeroplanes were on show, but all the time available was devoted to the study of the full-sized machines.

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*THE FYERS FAMILY.**

(*Continued*).

By Col. Robt. H. Vetch, c.b., late R.E.

In the preceding pages of this paper some account has been given of the children and descendants of Lieut.-General William Fyers, and before referring to the children and descendants of his brother Peter and of his sister Alexandrina, I venture to return to a grandchild of Lieut.-General William Fyers who bore a rather remarkable name. The eldest child of Elizabeth Lydia Fyers and General the Hon. William Henry Gardner was born under unusual circumstances in the autumn of 1804. Her grandparents and parents were all living in tents in a camp which had been formed at Europa Point during the time that the terrible visitation of sickness, commonly called the plague, was raging in the town. In memory of the place of her birth, and the circumstances surrounding it, the child was christened "Europa."

The sickness was a fever of a very malignant kind, and a book was published in 1815 by the distinguished Physician to the Forces, Sir James Fellowes, brother of Rear-Admiral Sir Thomas Fellowes, in which he gives an account of it. He calls it the *Andalusian Pestilence*. Certainly it made sad havoc at Gibraltar, and all who passed through that time had good cause to remember it.

It was said to have been brought to the Rock by a foreigner, who went to live in the neighbourhood of the married quarters of the Royal Artillery, in August, 1804. The disorder began in these quarters, and spread with an extraordinary rapidity and virulence until the whole fortress was infected. Out of a population reckoned at 6,000, with 4,000 additional of garrison, altogether 10,000, nearly 6,000 died between the month of August and the end of the year. It is absolutely appalling to contemplate a death rate of 60 per cent. in four months.

Strange to say, the Royal Military Artificers were the greatest sufferers of the garrison in proportion to their numbers. Their barracks at Hargraves' Parade were some distance from the place where the sickness began, yet early in October its ravages were so great that all work was suspended. A camp was formed at Buena

* *Corrigendum*. Letter of Lord Nelson from the *Medusa*, 4th August, 1801, on previous page. *For* Sir Esau Nepean *read* Sir Evan Nepean.

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Vista, but the plague followed them thither, and was worse than in the barracks. In August the companies of Royal Military Artificers mustered 263 of all ranks, and at the end of the month of December, when the epidemic ceased, 123 had died; but that is not all, for no less than 229 men were admitted to hospital with the fever, of whom 106 recovered, so that there were only 34 men effective when the sickness was at its worst.

Amid the alarm and fear that was general, brave men and women of loving heart were not wanting to volunteer their help in tending the wretched victims of the disease, who were deserted by all others. They sacrificed themselves in devotion to a common humanity. Among these were all classes; some privates of the garrison were notable examples of constant and indefatigable work in the plague-stricken town; they passed unscathed through the ordeal, although surrounded by the pest in its worst forms. Less fortunate than these were the Rev. J. T. Frome and his wife, whose services were so great among the sick and dying, but who themselves succumbed to the pestilence, leaving three little orphan children behind them.

I have received from Major Evan Fyers a copy of a letter, written in November, 1804, at the camp at Europa Point. It is from Anne Wanton, wife of Lieut.-General William Fyers, then Colonel Commanding Royal Engineer at Gibraltar, to her daughter Sarah (Mrs. Cornelius Mann, in Scotland), and was penned shortly before the birth of her granddaughter, Anne Europa Gardner; it gives a very vivid description of the state of affairs during this awful time. This letter is full of interest. Several officers of Royal Engineers are mentioned in it, in addition to those of other arms, and some side lights are thrown on small matters, it is true, but none the less worth recording. I therefore make no apology for giving the letter at length.

Letter from Mrs. Anne Fyers, wife of Lieut.-General William Fyers, R.E., to her daughter Sarah, wife of Major-General Cornelius Mann, R.E.

"GIBRALTAR, *November 3rd*, 1804.

"MY DEAR SALLY,

"It is certainly a long time since I have written to you, but as our girls wrote occasionally, I thought you would not be uneasy at not particularly hearing from me. This day is five weeks since we came to our encampment at lower Europa in the Governor's meadow. Mr. Mann will know the place. Our cousins Darby and Wilkinson who came with us have now returned to their houses, though much against their inclination, but Mrs. Wilkinson is so subject to the rheumatism that she did not like to sleep in a tent during the very heavy rains which appear to be coming on immediately. However, we have been dry as yet, but Mr. Fyers[o] urges us to go to town, as he also fears the bad effects of the rain.

[o] Her husband, Colonel Fyers.

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"The Doctors think we are more safe here, the air being so perfectly pure. We are also, they say, so much more liable to get the fever after leaving this than those who have been the whole time in the putrid air of Gibraltar, which is so offensive to Mr. Fyers and Gardner* that when they return from town (where they are sometimes obliged to go for half an hour) they are quite sick.

"I have once written to dear Charlotte,† and once to my good mother,‡ but except those I have not taken my pen to write a line since our arrival here till now.

"Eliza§ makes a very good soldier's wife. She is now very near her confinement. She has no idea of fear, although the wind blows their tent pins out of the ground at night, and the goats run about and nibble at the cords in such a way as would alarm anybody at first. Besides she knows that both Dr. and Mrs. Geddes are dead, and at present we do not know anyone to supply their place. However in some of the regiments there may be someone of this description. Mrs. Baynes embarked a few days ago in the *William*, store ship, with Frome's‖ three children for England.

"You can form no idea of their situation, nor indeed the distress of any family who have had this dreadfully . . . (words illegible). The servants of the house run off immediately, knowing they will be in the same situation if they remain. Mrs. Baynes was obliged to put both Mr. Frome and his wife in their coffins, not having a creature near her; nor could she get them buried till the Governor ordered some men who were then in the street to be pressed for that purpose. How the town is to be cleaned we can scarcely tell, as we fear that the dead bodies are at this moment shut up. For instance, Mr. Cordoza (went) on board ship at the first, but he wanted a few articles from his house, and requested that a young man of the De Rolls¶ should unlock the apartment which he had 'let' to a Jew. On doing this he was almost instantaneously struck with death, from the shocking smell which met him even before he had entered the shop.

"At a meeting of the inhabitants they have agreed to break open and examine such houses as have been left, as they fear there are a number of bodies unburied. One man at the sickness used to be for ever

* Her son-in-law, Capt. the Hon. W. H. Gardner, R.A.

† Her daughter, Mrs. Young.

‡ Old Mrs. Fyers, widow of Thomas Fyers, Overseer of the King's Works in Scotland.

§ Her daughter, the Hon. Mrs. W. H. Gardner.

‖ The Rev. J. T. Frome, one of the old Dorsetshire family, the Fromes of Woodlands. Both he and his wife died of the plague at this time at Gibraltar. One of the three children mentioned by Mrs. Fyers was the late General Edward C. Frome, Colonel Commandant, R.E., and at one time Inspector-General of Fortifications. He was the last recipient of the pension granted by a generous Government to the children of the Rev. J. T. Frome for the services rendered unto death by their devoted father and mother.

¶ A Hanoverian corps, which was with Abercromby at Alexandria.

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running to the main guard to beg they would remove the dead from one street, there being six persons lying there, and there was no other chance of getting their dead buried but by doing so. Miss Fleeter, who is now a very pretty young woman, was seen by Capt. Wilkinson throwing her dead father from the chamber window into the street, not having a creature near her, her mother had died some time before.

"Mr. Pritchard* of the Artillery is dead, and Mr. Palgrave of the Register Office, Mrs. Northe, Mrs. Wooden, Mrs. Bound, Mrs. Green, Mr. and Miss Gavins. Mrs. Way, Mr. and Mrs. Glyn, all are dead. We have only 30 artificers who have not had the fever; 106 have died and both the Winlows, poor old Dr. Sharpe and his wife, all the McDonalds, all the Master Artificers of every description except Mr. Johnstone the Carpenter. Hockings is still in England. Miss Hockings and her brother George are dead, also the Town Major. . . . All the Standlys are dead, with the mother; Williams the Pratique and Ponce the Deputy Pratique-Master are dead.

"*Tuesday 6th.*

"We have just heard that our friend, Capt. (Arthur) Wilkinson,† caught the fever as soon as they went to town. Yesterday we were nearly packed up to go, but this news, with the Doctor's opinion on the subject, has induced us to stay till all danger is over. Capt. Darby, Capt. Heywood, and Lieut. Cuthbert, of the 54th Regt., are all ill, also Mr. Sweetland; Gardner says old Mr. Geddes is still alive, although very weak. It was the Doctor's wife who died a few days ago, and the report of the old lady's death arose from seeing the coffin which she had bespoke to be buried in carried to her house. Neither are the Winlows yet dead, but they are everything but dead.

"*Saturday 10th.*

"Our poor good friend, Capt. Wilkinson, died two days ago. As Colonel‡ and Mrs. Darby have never left their house, they will I fear get this dreadful infection. Pym says you may talk of the fever of the West Indies, but he never had an idea of anything so very dreadful as the fever that now rages here. Major Adye§, Dr. Pym‖, and Capt. Lee, A.D.C. to General B——, went to Malta two or three months before this sickness broke out, but as they could not all return in the same vessel, they drew lots which should come first, unfortunately for Adye, who, poor man, thought himself particularly favoured in getting here two days before his forage money was paid. I think he died in about a week after his arrival. He had his senses to the last, which is an uncommon circumstance, and told Capt. Campbell that his wife and children were left in very good circumstances, she having 5,000 of her own.

* Lieut. John Pritchard, R.A., died 17th October, 1804.

† 13th Foot.

‡ 54th Foot.

§ Capt. R. Willett Adye, R.A., died at Gibraltar on the 22nd October, 1804.

‖ Surgeon-Major William Pym, Headquarter Staff.

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"Mrs. Brown, who was the daughter of Colonel Spry,* was buried yesterday in South Port Ditch, where the beautiful Mrs. Jephson† and many others lay. Capt. (John Beaver) Brown, who married her some time ago, is a poor creature, but the ladies of the 13th Regt., to which he belongs, permitted him to visit them, as they lived at the South. I never saw her except once, but so different from what she was when I saw her in London 19 years ago, when her father's carriage, with several servants attending, brought her of a Saturday evening from Boarding School. I certainly should never have guessed her to have been the same. She has grown very fat and her face as red as scarlet. After we passed, the children cried out 'Oh! Mama, did you ever see so extraordinary a looking woman.'

"Capt. Thackeray‡ left the Governor (Lieut.-General Sir Thos. Trigge, K.B., Lieut.-Governor of Gibraltar) about a week ago, and has pitched his tent with his brother officers of Engineers. It appears that after the Barrack Master's decease Thackeray asked the Governor to let him do the duty of that office until another was appointed, as he thought it might give him the rank of Major in the Army. The Governor told him he did not think it would be the least advantage to him; besides, he meant to offer it to Capt. Young, of the 13th Regt. Thackeray ran to Mr. Fyers to ask his advice, as he said, in case the Governor did not appoint him, he was determined not to remain in his family. Mr. Fyers strongly advised him against taking so rash a step, but Thackeray said it was the second time he had been served in this way. He had been his first A.D.C. when in the West Indies, and instead of sending him with the account of a victory, etc., Sir Thomas sent a young man who was perfectly indifferent to him. It was true Sir Thomas gave *him* the £200 or £300 which is granted on those occasions, but this did not satisfy him, as promotion was what he was most anxious for. On his return to the Convent, the Governor told him that he had just settled the matter with Capt. Young, who was to have Major Andrews's appointment until further orders. Upon this Thackeray stept upstairs, stript off his red coat and put on his blue§; then coming quickly past Sir Thomas, wished him 'a good morning.' Sir Thomas called him back and told him he thought he had better consider on what he was about to do, but Thackeray told him he had most thoroughly considered it.

11th.

"Gardner‖ has returned from town, where he has heard that my cousin Darby is ill, also Colonel (John) Keane, now of the 13th Regt.

* Lieut.-General William Spry, R.E. It will be remembered that he was godfather to Mrs. Sarah Mann, and Mrs. Fyers is alluding to the time when she met him in London in 1785. He was then a Lieutenant-Colonel. He died in London on 12th July, 1802.

† Wife of Richard Jephson, Deputy Judge Advocate at Gibraltar.

‡ Afterwards General F. R. Thackeray, C.B., Colonel Commandant, R.E.

§ The uniform of the Royal Engineers was changed in 1782 from scarlet to blue, faced with black velvet. Thackeray's uniform as an A.D.C. would have been red.

‖ Capt. the Hon. W. H. Gardner, R.A.

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You will recollect him a sub. under Colonel Ogilvy, I think of the 44th Regt. Old Mr. Witham died this morning. Almost all old Mr. Cooper's family are gone. We have just been informed that they have a dreadful fever at Leghorn; God grant that it may never reach England. We are particularly favoured in our situation here, where not a soul can get at us, and our being so near to the sea is a great comfort.

"Capt. Gore (Sir John Gore), Capt. Pearce, and Capt. Bosenhagen have very much contributed to our comfort by calling continually, or, rather, rowing past our tents, where they generally 'lay to,' and with a speaking trumpet we could hold a conversation. They also brought us two sheep, two dozen fowls, six turkeys, six ducks, with cheese, vinegar, etc., etc. This you may suppose is a great comfort to us, as whenever we do send into town, it is done with fear and trembling.

"Colonel Smith, R.A.,* with his wife and four charming daughters, are now here. They have during the sickness remained in the quarters left by Colonel Wellington, and as yet have done well. Morvet has lost the little white-haired girl who danced so well; you remember she sang on board Sir James Saumarez's ship. Joseph† the hairdresser died among the first, also Mr. Hollister and his wife, your servant Slocum, and our man Smith, Sally Webber and child, and Major Bellew,‡ who was very anxious to marry poor Sally, had not Colonel Darby prevented it. They are all dead. The young man is also dead that married Nancy Warner. Poor old Sherres died yesterday, and one of the Winlows. The woman, Mrs. Staker, who nursed one child is dead.

"General Trigge called at our tent this morning. I fancy a Spanish war is hourly expected,§ so that we are beset on all sides. As soon as this is declared, Sir Thomas must shut up the gates; in that case I know not what we shall do, as we had concluded on Mrs. Gardner lying-in here, the Doctors having said that it would be death for us to go to town. Every person who left the south for the town (to the northward) last week is sick, and several died, so that we must stay if possible. The Malaga fever is nearly over; about one person dies in three days, except such as come fresh from the country, who do not live more than two days after their arrival.

"*Monday 12th.*

"The *William* has just returned after an absence of 10 days. I will send this if possible. I hear Mrs. Baynes is well. Colonel Holmes and Capt. Gaskell, of the 10th, are in the ship with Mrs. Baynes. We have just heard of the death of Capt. Heywood, of the 54th Regt. Mr. Cuthbert died some time before. We are all, thank God, most wonderfully well; we eat our brown bread with the greatest relish, and if it was not for the dreadful sickness we should have thought the six

* Afterwards General Sir John Smith, G.C.H., and Lieut.-Governor of Gibraltar.

† Joseph, the German barber, employed by Colonel Fyers (see *ante*).

‡ Major Patrick Bellew, 54th Foot.

§ Spain declared war against England on December 12th, 1804.

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weeks which we have been here delightful, but every day brings news of the death of some of our friends.

"You will have heard of Gore and Capt. Sutton and some other captains' success,* and, if you have not, you must write to Capt. Young, for I have not time to tell you particulars. I think our friend, Sir R. Barlow, was one of the fortunate heroes.

"God bless you. We are all thinking of Eliza, as she expects to be confined at the end of the month, or the first of next. I am sure you will laugh at the sort of room she is to be in. Ten days ago we had dreadful lightning and thunder and rain. Their tent appeared to be all on fire. Gardner declares he was so frightened that he could not shut his eyes all night, but that Eliza thought nothing of it, as he had assured her the tent was perfectly fastened, so that it could not blow down. Eliza has made up her baby clothes to admiration, but we were obliged to send to town for all cambric, etc.

"God bless you. Adieu, and believe me your most affectionate mother,

"ANNE FYERS."

Another gossipy letter to the same daughter from Mrs. Fyers, containing allusions to several officers of the Corps, has been preserved. It is not dated, but as it was written from London, where Colonel and Mrs. Fyers arrived from Gibraltar in May, 1807, it is tolerably easy from internal evidence to infer that it was written in the autumn of 1807, from the house they had recently taken in Portugal Street, Grosvenor Square. Sarah Mann at this time was in Ireland, where her husband was quartered at Athlone.

* Note by Evan W. H. Fyers :—

A description of this action will be found in Sir Wm. Laird Clowes's *History of the Royal Navy*, Vol. V., p. 350, derived from James, the Nelson Despatches, and the Naval Chronicle.

On October 5th a British squadron, acting under special secret orders from the Admiralty, and consisting of *Indefatigable*, Capt. Graham Moore, *Lively*, Capt. Graham Eden Hamond, *Medusa*, Capt. John Gore, and *Amphion*, Capt. Samuel Sutton, captured off Cadiz a squadron of four Spanish ships just arrived from Montevideo laden with treasure, which, though carried by neutral ships, was obviously destined to be used by the French. One Spanish ship (the *Mercedes*) sank, not more than 46 of her company being saved; but cargoes valued at a total of about £1,000,000 were taken with the other three. The Spanish were much weaker in force than the British, and were taken unprepared. Capt. Sir Robert Barlow, Kt., was at that moment on his way in the *Triumph* to Cadiz.

The action was severely denounced both at home and abroad, and led to the declaration of war by Spain two months later. Capt. Moore would appear to have exceeded his instructions, which were limited to detaining the ships "until His Majesty's pleasure shall be further known."

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Letter from Mrs. Anne Fyers, wife of Colonel (afterwards Lieut.-General) Wm. Fyers, R.E., to her daughter Sarah, wife of Capt. (afterwards Major-General) Cornelius Mann, R.E.

"LONDON.

"MY DEAR SALLY,

"As Capt. and Mrs. Buchanan* go in a few days to Ireland, I shall not permit them to depart without a few lines. I have been rather unwell for the last three months with a pain in my back, which does not much affect me till about 5 o'clock in the afternoon, when I have not been able to lay, walk, or sit for more than two minutes at a time; it leaves me at 11 or 12, when I sleep well until morning. I was under the necessity of sending for a physician, who tells me I am in no danger, as it is a very common complaint. I had flattered myself that, after all the fatigue and trouble of nursing and bringing up children, everything would go on well, and that I should have nothing to do but attend the family and amuse myself. But, alas! I now know that no age is free from danger. Poor Mrs. Fox is a proof of this. She was boasting of her good health at Gibraltar, when it was discovered not many months after that a cancer was making its appearance (this is two years ago), and she is not now expected to live many weeks. General Fox† is very well; they live at no great distance from us.

"Charlotte is now at Portsmouth, where she will remain till Young‡ sails.

"General Gother Mann§ dined with us about 10 days ago. He is to go to Portsmouth when Sir G. Provost‖ is removed. I think they will be very happy there, but I am sorry that Mrs. Mann's indisposition will prevent her from enjoying the beauties of the garden. We found General Mann very pleasant, and not formal as we expected.

"Your Uncle Peter¶ has been ill since his return from Copenhagen. He took a drawing of the place, which he gave to Mr. Barker,** and it will soon be exhibited to the public eye.

"Edward†† is behaving well, and is reported by the person who superintends the surveying party very diligent.

"Mr. Fyers‡‡ has just received orders to have three horses kept for him, which will lessen the expense of keeping a carriage, which is enormous. I hope you will never live in London. I believe I told you in a former

* Capt. Gilbert Buchanan, R.E. He became a Lieut.-Colonel in 1825, and died at Chatham in 1830.

† General the Hon. Henry Edward Fox, son of the first Lord Holland.

‡ Capt. (afterwards Vice-Admiral) James Young, R.N.

§ Afterwards Inspector-General of Fortifications.

‖ Major-General Sir George Provost, of the 60th Foot, 1st Bart., who went to Nova Scotia as Lieut.-Governor in 1808.

¶ Capt. (afterwards Major-General) Peter Fyers, R.A.

** W. Barnard?

†† Her son, Edward Fyers, was then a Woolwich Cadet, and going through the final course of surveying under the Ordnance Survey.

‡‡ *i.e.*, Colonel Fyers. His wife always so called him.

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letter that Sir C. Holloway* was very averse to going to Gibraltar. I have however since heard that Mrs. E. is quite an inmate of Sir Charles's family, but I fancy it will not be long before she will discover to them the 'cloven foot.'

"How fortunate we consider ourselves in being out of Gibraltar at this time, and yet how very unfortunate I considered our removal from that place. Here is another proof how little we know what is for the best.

"We find our new house very comfortable as well as elegant, and we now have, after changing and changing again, got very excellent servants. Our coachman assists at table, so that one footman serves, as we go out but little, and the housemaid assists the footman, she having been accustomed to live where no footman was kept. Our cook is also a very quiet and economical woman. She keeps the dining room, steps, etc., in order, besides the kitchen, so that we have only four servants. We had five, but I found I got so little work done that I could not keep a fine lady's maid at 18 guineas a year.

"I was in hopes your papa's picture† would have been engraved before Capt. B.‡ left, as then we should have presented you with a copy, but I fear it will require a week longer. You will find Capt. and Mrs. Buchanan a great acquisition to your society; although Mrs. B. is rather quiet, she does not want for understanding. On the contrary, I think her very clever; she dances very well. Capt. B. is an uncommon officer, and a most honourable gentlemanlike young man.

"Your excellent father is perfectly well. He is just gone to dine with General Morse,§ where he is to meet General Twiss, General Mann, Colonel D'Arcy,‖ etc. He is very happy in his appointment,¶ it being exactly what he likes. Doctor Pym°° came from Messina with General Fox; he is not very well. This is a shocking climate. How do you exist in Ireland? It is a very great pleasure to know that you have such kind friends in Colonel and Mrs. Fisher††; the Buchanans are quite pleased to find that they, with Miss Fisher, are in Ireland.

"Eliza and Gardner‡‡ beg to be kindly remembered; they will write to you soon. Our children have grown out of your knowledge. Mrs.

° Lieut.-Colonel (afterwards Major-General) Sir C. Holloway, R.E., who went through the celebrated Siege of Gibraltar in the years 1779 to 1783, and had now been appointed to succeed Colonel W. Fyers as Commanding Royal Engineer there.

† The portrait by John Hoppner, R.A., painted for the Garrison Library, at Gibraltar, which was engraved by Henry Meyer.

‡ Capt. Buchanan.

§ Then Inspector-General of Fortifications.

‖ Lieut.-Colonel (afterwards Major-General) Robert D'Arcy, C.B., R.E., died in 1827.

¶ Deputy Inspector-General of Fortifications.

°° Surgeon-Major William Pym.

†† Colonel (afterwards Major-General) Benjamin Fisher, R.E. He died at Portsmouth in 1814.

‡‡ Capt. the Hon. W. H. Gardner, R.A.

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Thomas Fyers* makes an excellent wife; she is again in a thriving way! Their son is a lovely child.† They come in their gig to dine with us once a week. We think it likely Mr. Fyers and myself may go to Scotland in the summer by way of duty. My love to Capt. Mann, and kiss all the young ones for grandmama. I hope you do not spoil them.

"I saw Whitmore‡ a few days ago; he was on a visit to his mother, who is ill. He says he is not so fond of plays as formerly. Mrs. W. has grown stout. I hear they are very happy. Mrs. Eyre§ looks, they say, very well. . . ."

The end of this letter is lost.

Mrs. William Fyers died at the house in Portugal Street on the 27th September, 1808, aged 54 years, less than a year after this letter was written.

After this digression, I proceed to notice the children and descendants of Major-General Peter Fyers.

* Louisa Clifton, wife of her son Thomas, afterwards Major-General, R.E. Capt. Thomas Fyers was then quartered at Chatham.

† This was the first child, who was born at Gillingham, Kent, in February, 1807. He was afterwards in the 11th Foot.

‡ Capt. (afterwards General Sir) George Whitmore, K.C.H., Colonel Commandant, R.E.

§ Wife of Lieut. J. W. Eyre, R.E., who died at Tobago in 1825.

(*To be continued*).

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RAILWAY SLEEPERS.

By Lieut. G. C. V. Fenton, R.E.

Many forms of railway sleepers have been used in the development of railways, and yet apparently the last word has not been said on the subject, as the ever-appearing reinforced concrete has been suggested as the material for this important purpose. Stone sleepers were tried, but it was found that the road was too hard and unyielding, and they were soon discarded. Steel sleepers were used experimentally in England by the London and North Western, and Metropolitan Railways. They too have been dropped, and the whole of the railways in England are practically all laid on wood sleepers. In India, and other places, where the white ant abounds, the steel sleeper holds its own, but the use of teak and creosoted pine, and other hard woods appears to be considerable.

Wood sleepers are used in two forms, transverse and longitudinal, but the latter are only employed in the case of certain bridges, where the transverse sleeper would be unsuitable. With the exception of a limited number of larch and fir sleepers grown in this country, the majority of timber for this purpose is imported from the Baltic. It is brought over in logs or blocks, each 8′ 11″ long, and about 10″ × 10″ in section, and when sawn down the middle, each block forms two sleepers. The specification for the timber, as issued by the Midland Railway Company, is contained in Appendix A.

These sleepers, when received, are in a comparatively green condition, and they are seasoned by being stacked in the open air for *at least* six months, and if possible for much longer. The method of stacking is in rectangular heaps, made by layers of sleepers placed on edge, with about 1″ air space between, and each layer separated from the next by a row of sleepers on their flat sides, placed at each end of the stack. This allows a good current of air round each sleeper and gives the whole stack a fair chance of seasoning.

A railway sleeper is particularly exposed to deterioration, being surrounded practically on three sides by moist ballast, while the top is more or less uncovered. Many processes have been tried to preserve timber, but the system which has given the best results is creosoting, and this method is adopted by all the railways in England.

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Creosote is a dark oily liquid distilled from coal tar, and as used, is about the same consistency as thick treacle when cold, but when heated becomes only slightly thicker than water. The Midland Railway's specification for creosote is contained in Appendix B, and a plan of the Midland Railway Company's creosoting works at Beeston is attached, the method of procedure being as follows :—

The sleepers are stacked in the method described above at the Nottingham end of the works, and, when required, are loaded on to small carrier trucks, which are run on the narrow gauge line between the stacks. Each truck carries 45 sleepers, and is at present drawn by horses to the shed where the boring machines are, but it is proposed to substitute a small travelling crane for the horse traction.

These boring machines are two in number and are driven by an 8-H.P. engine; each consists of two sets of drills, four in each set, situated in the relatively correct position to drill the holes for the chairs on each sleeper, and the sleepers are loaded from the trucks on to the endless chain carrier, which conveys them under the machine. The man working the machine stops each sleeper as it passes under, raises a catch which holds it firmly in the correct position, and depresses the boring machine gear, and thus drills the holes. The sleeper then passes on to be loaded up on to another empty truck waiting to receive it at the other end of the carrier. These machines can bore three sleepers a minute on an average throughout the working day.

The creosote is received in railway oil tanks, which are run alongside the storage tank, the capacity of which is 28,290 gallons, and empties into it. This tank is heated by steam pipes, which pass through the creosote and raise its temperature until it becomes a fairly thin liquid. The creosote is run from the storage tank as required into the working tanks, of which there are two. Each working tank is provided with an indicator to show the amount of creosote in it, and is warmed by steam pipes in a similar manner as the storage tank.

There are two creosoting cylinders, one 75′ in length and the other 54′, but it is proposed to lengthen it to 75′ in the next few months. These cylinders are 6′ in diameter, and the narrow gauge line is laid right through them in continuation of the lines from the boring machines. They are fitted at each end with strong air-tight doors, which are held in position by a number of strong clamps. These doors can be easily removed and run alongside when it is required to charge the cylinder with sleepers.

The space between the rails in the cylinders is packed with sleepers, and the trucks loaded with sleepers are run in, until the

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whole is filled. The doors at each end are then put on and secured. The 75′ cylinder holds 400 sleepers and the 54′ 300.

Each cylinder is connected with the 10-H.P. engine, which consists of two pumps, one capable of forming a vacuum in the cylinder and the other for pumping in creosote.

The vacuum pump is put on for 10 minutes and withdraws all the air from the cylinder. The engine is then stopped and a cock from one of the working tanks is opened, and creosote rushes from it and fills up the cylinder. As soon as the cylinder is full, the reading on the indicator of the working tank is read and noted. Each sleeper, for proper creosoting, should absorb $3\frac{1}{8}$ cubic feet of creosote, and this is equivalent to $2\frac{1}{2}$ gallons. From this data the amount of creosote required for the sleepers in the cylinders is calculated, and the creosote pump is started and continued at work until the reading on the indicator of the working tank shows that the required volume of creosote has been pumped into the cylinder. As soon as this is done, the pump is stopped, and the cock from the working tank is opened, and the creosote allowed to drain back into the tank. The vacuum pump is then started to withdraw all surplus creosote, after which the doors are opened and the sleepers run out at the Trent end, and are there laid out to have the chairs attached.

The time taken for this process varies according to the state of the sleepers. The process is speedy when the wood is dry, but when the wood is wet, or in cold weather when the sap becomes frozen, the time taken to pump in the required amount of creosote becomes much longer. The cylinders are provided with relief valves, which open at 120 lbs. per square inch, but that pressure is rarely required. On an average dry spring day the time taken with each cylinder for the different processes is tabulated below, the indicator on each cylinder showing a pressure of 20 lbs. per square inch only, when the required amount of creosote had been forced in.

	Cylinder, 54′ long.	Cylinder, 75′ long.
Vacuum	10 minutes	10 minutes
Filling with creosote	15 minutes	12 minutes
Pumping in creosote	50 minutes	60 minutes
Emptying	30 minutes	25 minutes
Revacuum	10 minutes	10 minutes
Total	1 hour 55 minutes	1 hour 57 minutes

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Wood sleepers are laid in a track in both positions, sap-side up and sap-side down, most railways preferring the former, but the Midland Railway use the latter method. They claim that in laying in the latter way, the chairs can be placed direct on the sleeper without any adzing to give a bearing, thus saving in labour and also in the life of the timber, as it does not give any break in the surface through which the wet might percolate into the body of the sleeper, and thus cause rotting. The average life of a railway sleeper is from 12 to 18 years, and it is generally sound enough at the end of that period for level-crossing places, fencing, loading banks, and similar work, or for use in sidings. The cost of a sleeper as landed in England is about 2s. 6d., and the creosoting brings it up to 3s. 3d. When it has done its work, it can generally be cut up for firewood, and will bring in about 1s. when sold for that purpose.

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APPENDIX A.

SPECIFICATION FOR REDWOOD SLEEPERS.

The sleepers shall be rectangular, of Baltic red timber, of Dantzig, Memel, or Riga shipment, 8′ 11″ long by 10″ by 5″ in section. They shall be cut from blocks of 10″ × 10″, and shall be straight, sound, of good quality, and free from large and dead knots and shakes. Not more than 1 per cent. of the sleepers shall be imported sawn, and at least 55 per cent. shall have a flat surface of 10″. The sleepers shall be submitted for inspection in entire cargoes, as imported without any previous selection having been made therefrom.

Power is retained to reject as defective, either before or after delivery, all unsound sleepers, all sleepers having a wane exceeding 1″ on each of the two outside angles, and presenting less than 8″ of flat surface on the outside at the smallest part, or any sleepers which do not in every respect comply with the specification.

APPENDIX B.

SPECIFICATION FOR COAL TAR CREOSOTE.

The creosote shall be obtained exclusively by the distillation of coal tar, and shall not contain more than 3 per cent. of mechanically mixed water. It shall become perfectly fluid when raised to a temperature of 100° Fahr., and shall remain perfectly fluid at a temperature of 90° Fahr. It shall have a specific gravity of from 1,040 to 1,065 at 90° Fahr., as compared with water (= 1,000) at 60° Fahr. The creosote shall contain not less than 25 per cent. (by volume) of oils that do not distil over at a temperature of 600° Fahr. when tested in accordance with the instructions given below, and the distillate at 600° Fahr. shall yield not less than 6 per cent. (by volume) of phenols.

Process for Testing Coal Tar Creosote.

The sample is to be warmed, if necessary, until it is perfectly fluid. 100 c.c. of the well-mixed creosote is to be then poured into a 4-oz. tubulated retort, and heated gradually to a temperature of 600° Fahr. over a naked flame surrounded by a screen, the distillate being collected in a 100-c.c. graduated cylinder. The thermometer is to be immersed, so that at the end of the distillation the bulb is just out of the oil. The flame is to be arranged so that the distillation of the oil after all water has passed over, and the oil has commenced to distil quietly, shall occupy from 18 to 22 minutes. The distillate is to be measured at the same temperature as the original creosote.

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The distillate obtained above is to be poured into a stoppered flask of about 250 c.c. capacity, and vigorously shaken with 30 c.c. of a solution of caustic soda of specific gravity 1·21. The flask is to be then placed on a steam bath heated to about 180° Fahr., and again shaken vigorously for at least one minute. The contents of the flask are to be next poured into a separating funnel, and allowed to stand until the liquids have completely separated; the soda solution is then to be drawn off into a 10-oz. stoppered separating funnel. The oil left in the separating funnel is to be returned to the flask and treated as before, but using only 15 c.c. of the caustic soda solution. After the soda solution has again been drawn off, the treatment is to be repeated a third time if necessary.

The mixed alkaline solution in the separator is to be made quite cold, and well shaken with about 70 c.c. of ether to remove any neutral tar oils which have escaped separation, and after the ether has completely separated, the soda solution is to be drawn off into an 8-oz. wide-necked flask and heated until the dissolved ether has completely evaporated, after which the alkaline liquid is to be cooled and treated with dilute sulphuric acid (1 vol. of strong acid to 3 vols. of water) until the solution is slightly acid and the crude phenols have completely separated. The whole is to be then poured into a graduated 100-c.c. or 150-c.c. cylinder and the volume of phenols read off when cold.

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TRANSCRIPT.

THE FINAL STRUGGLE FOR 203-METRE HILL AT PORT ARTHUR.

Translation of an article by Staff-Capt. Kostiushko in the March, April, and May numbers of the *Eenzhenernee Zhoornal.*

(*Continued*).

After he had sent away his last reserve General Irman was very anxious about the fate of the hill, and could not wait for the joyful news of the repulse of the Japanese, but himself rode up there, taking with him the writer of this account and two mounted volunteers. The newly appointed commandant of Visokaya, Captain Pobilevsky, 26th Regiment, accompanied them.

The distance from the 5th Regiment Headquarters to the hill was from 1 to 1¼ miles, and lay along the Tea Ravine, which was now swept with rifle fire from the hill, so that the whole way bullets were singing overhead and falling alongside, but did little harm, as the Japanese, owing to the darkness, could only fire at random. One or two ricocheted at the very feet of General Irman's horse and frightened him so that he jumped to one side, but the General succeeded in quieting him.

Visokaya Hill, on which at that time a desperate battle was raging, presented a most majestic and effective picture. In the dim light of the stars its terrible silhouette was being lighted up by fiery flashes of all kinds.

Common shells bursting on the side of the hill turned towards the riders, formed sheaves of brilliant light, from the top and sides of which brown-coloured sparks flew in all directions. This light would burst out unexpectedly in various places, and, after brightening up for two or three seconds the sombre repulsive silhouette of the hill, would suddenly die out. The bigger the shells, the larger the sheaves of light which burst from them, and the longer they remained visible. At the same time the neighbourhood resounded with the crashes of the explosions and the whistling of flying splinters and stones. This was the impression given by the common shell. The shrapnel burst at some distance from the hill, producing long tongues of fire, which were quickly extinguished. The air mines which were thrown by the Japanese, on bursting, threw up enormous sheaves of fire on the crest and on the Japanese side of the hill, and very rarely on the Russian side. The hand grenades thrown by the Russians burst on the far slope, and each with its brief flash lighted up

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the crest for a single moment; but the finest effect was produced by the *rak-a-rok* candles and rockets.

In the darkness of the night it was difficult to carry on the fighting without seeing the enemy; in the eyes of wearied men the enemy appeared to be on all sides, and they fired at random, without taking aim. To overcome this, the officers of the mining company had invented a candle which was about the size of a large radish (in length about 14" to 16", and 3" in diameter). The combatants were within 20 to 30 paces of one another, and in places even nearer, and at such a distance it was easy for the Russians to throw a candle by hand with such accuracy that it would fall in rear of the enemy and show up their figures distinctly against its light. Some of these candles burnt with a bright red, uncanny light, while others gave a white light, like that of acetylene gas, and they weirdly lighted up the crest of the hill, as it stood out darkly against the lighter heavens. Each candle burnt for a minute or somewhat longer, and its burning was accompanied with the continuous crackling of the Russian rifles.

From time to time also rockets soared into the sky, but they proved less serviceable to the Russians, because bursting overhead they lighted up both combatants equally.

By all these lighting effects Visokaya Hill was illuminated in an extremely varied and beautiful manner.

Close up to the hill in the head of the ravine was an enormous accumulation of men. Some were boiling something in kettles, others were eating something, or drinking from their waterbottles; around a belated travelling kitchen a group of cooks was collected, and these as usual were jostling and abusing one another. Near a dressing station there was a crowd, chiefly of stretcher-bearers and wounded. Such groups need not have attracted attention, as both dressing stations and kitchens are natural adjuncts to the rear of a position. But besides these, on both sides of the road, with their heads on the sides of the ravine, men of all sorts of detachments lay and slept side by side, and so many were there that General Irman asked who they were. At first the writer thought they must be the dead, but a touch convinced him of his error—they were neither dead nor even wounded.

On being roused some of them were found to be so utterly exhausted that no intelligent answers could be got from them, while others said that they had been sent down from the hill because they suffered from night blindness and became useless at nightfall. But others, who were having a comfortable tea round a small fire, had no better excuses than that their eyesight was naturally bad, while others said that they were suffering from slight wounds, but were not allowed to go to hospital.

It may be mentioned here that subsequent enquiries elicited the fact that it actually was the custom to send down at night those who suffered from night blindness; but there were not very many of them, although as the men became weaker the number of sufferers progressively increased, until out of every five riflemen three were suffering from night blindness, while among the sailors the percentage was somewhat less; yet all were not sent away, or no one would have been left to defend the hill, and

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there were sent down only those who had long been sufferers from this disease. By day these men returned to the hill, but not all of them, some stayed on all day under the hill. As to those who said that they were wounded, it may be remembered that on the 29th November parties of convalescent wounded were sent out of the hospitals to form a reserve. The strongest of these had been sent to Visokaya, but having crawled as far as the hill, some of them were quite unable to climb up it, and so remained at the bottom.

During the 1st and 2nd December the Japanese became quieter, and good order was established in rear of Visokaya Hill.

On mounting the hill General Irman and his escort learnt that the assault had been finally repulsed, and that the whole of the position was, as at first, in possession of the Russians. Rifle fire was heard occasionally, but grenades and shells fell continually, though in considerably less quantity than by day.

Stumbling up the rocky slope and over heaps of rubbish, they eventually reached the top of the hill, and here the picture was very far from being as enchanting as it had been from afar.

Visokaya Hill had completely lost its original form, and presented to view a mound of broken stones and fragments of wood, rags, and corpses. The 11″ shells on striking the rock broke off great blocks, which successive shell broke up into smaller pieces, so that by the 30th November no more blocks remained, and only small rubbish, which covered the face of the hill to a depth of about 2½′.

Of the 43 blindages, by the 30th November only two on the left flank remained uninjured. A shell had even struck the edge of the commandant's blindage, which was also the telephone room, but it had fortunately been only a 6″, and had not wrecked it.

The rest of the works, such as the shrapnel hoods, were completely destroyed; in several of the blindages several shells had fallen, and these had converted enormous beams into awkward chunks and rubbish.

In order that the reader may appreciate what a ruined blindage looked like and with what horrors its destruction was attended, the following report of Sapper Peter Oleinik, of the Kwantung Sapper Company, is published in full:—

"I do not remember the date, but one evening an 11″ shell wrecked a blindage on the left flank of Visokaya. They at once sent for us, nine men of the Sappers, to dig it out. When I reached the ruined blindage a terrible picture met my view—almost in the very middle of the blindage there was a crater 5′ deep and 10½′ wide, from the midst of which, as well as from the entrance of the blindage, rose the smoke of smouldering mattresses and sand-bags and the suffocating stench of the gases of the explosion. From within came groans, wails, and cries for water and help. These cries ended sometimes in heart-breaking petitions, sometimes even in abuse. The first to whom my attention was directed was a junior N.C.O. of the 5th Regiment; he lay on his back; his head, arms, and the upper part of his chest appeared from under the ruined blindage, but the rest of his body was buried and so crushed that he in vain

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struggled to free himself from under this frightful mixture of earth, beams, sleepers, rails, and iron sheets. We fetched three buckets of water, and when we had extinguished the smouldering sacks and mattresses we began to dig out those who were buried alive. We got out the N.C.O. first; he was badly crushed and had both legs broken. As we reached the others, we became more horrified; all were badly mutilated, almost all had arms and legs broken and their hair burnt off. One had his head completely crushed, but all showed signs of life. There were no stretchers, so we removed the sufferers in cloaks, in which many died at once; a few of the men were only badly crushed, but without any limbs broken. When no more groans were heard we stopped work, assuming that all the rest were dead."

There were sometimes as many as 10 to 12 men buried in the ruined blindages under splinters of wood and stones. During the fighting there were neither time nor spare hands to dig them out. During the night fresh trenches were built up over the old ones of sacks filled with the rubbish. These trenches in their turn were very quickly wrecked, and from them pieces of the sacks flew like cloths over the whole hill And so the hill had a very unattractive appearance, no trenches, no cover, only deep craters and a universal heap of rubbish. General Irman first of all turned towards the commandant's blindage, but Tretyakov was not there; he, after driving off the Japanese and going round the position, lay down under a light shrapnel hood which had accidentally escaped injury; he was half lying, resting his head on a stone and apparently dozing, but at Irman's approach he got up, clad in a short black fur coat, and greeted him.

Weariness and exhaustion, already giving place to complete apathy, appeared in every feature. His face and beard were covered with a thick layer of dust, but his ever bright kindly eyes, although bloodshot, to some extent animated his face. He had been deafened by his contusions, and from tremendous shouting all day he had lost his voice and spoke very softly. Besides this he had a splinter of shell in his back and had had no time to get it dressed. All this showed that more had been taken out of him than would have been expected from an ordinary man, and that he, more than anyone, required rest.

The second in command to General Tretyakov on Visokaya Hill was Lieut.-Colonel Seifulin, 5th Regiment, who had arrived on the hill after Stempnevski had been wounded, and was evidently less fatigued than his commanding officer.

"Now, as you see, there is a lull," said Tretyakov, although this was by no means evident, for in reality grenades and shells were bursting all around; but this was really a lull when compared with the hell which had existed on the hill during the whole day and evening.

Passing round the hill, Irman and Tretyakov turned into the telephone blindage and, sitting on the bench which had served Capt. Stempnevski as a bed, began to give their opinions on the matter of Visokaya Hill.

General Irman was of opinion that Visokaya expended too many of the reserves, of which there were really none to spare.

General Tretyakov at first only listened, but later, when Irman asked

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him what he thought about the fate of the hill, he said that its days were numbered, that they could hold it for three to five days more, possibly for a week, but with great loss, and in the end it must be given up, because there would be no one left to defend it. Its only chance of safety was that the Japanese might suspend their assaults for a week or two; then it might be re-fortified, even to a small extent, and new troops collected. But this is just what the Japanese would not do; they were now attacking each day more strenuously, and in all likelihood they would continue attacking it whatever happened. This they could do the more easily as they were losing comparatively few men, while the Russians from their artillery fire were losing masses.

During this conversation several times riflemen came running up with various reports.

"Your Excellency! In the left redoubt the grenades are all expended; please sanction more."

"Here are some grenades," counting out twenty, "Be careful of them."

A N.C.O. came running up.

"Your Excellency! In the left redoubt we have only seven men left, including two sailors, who will soon go away; please grant a section to enable us to defeat the Japanese should they approach."

"Send 10 men more from the reserve; keep up your spirits."

"It shall be done, your Excellency."

A rifleman ran up, out of breath.

"Your Excellency! The Japanese are coming round our left."

"Where?" asked Tretyakov, quite calmly.

"There where the slope runs into the ravine, in order to get at us from behind."

Everyone sprang out of the blindage and, with alarm, peered down the left flank of the hill to where the man pointed.

"There is no one getting round! It is your fancy," Tretyakov again answered, calmly and confidently.

"They are getting round, your Excellency! By God, I saw them myself, and the section commander also said so; they are moving on the slope down which you are looking. Why should I tell you a lie?" answered the rifleman.

"And I tell you that you are making a mistake," replied Tretyakov, and he sent off a volunteer to find out if the Japanese were coming round at the place pointed out. After some time the volunteer returned and reported that they were not, but were sitting still in their saps.

"Why did you say they were moving round? Where are they?"

"Marvellous! But they certainly were doing so; I saw them, and the section commander also . . . ," murmured the confused rifleman.

"Well, now go and convince your section."

"It shall be done. Pardon for having disturbed you," and he went away.

"They are continually reporting turning movements to me; I am used to it," the General explained in the same calm voice, very softly, from his hoarseness. "The men, you see, are utterly tired. Their nerves are so strained that in the night they imagine all kinds of evil. And it is impossible to blame them—they are all brave—they are heroes!"

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"Colonel," said the writer to General Tretyakov, "is it possible that there are only 17 men in the left redoubt, including the reinforcement you have just sent?"

"Probably 17, unless any have since been killed or wounded."

"But surely that is too few for the defence of the redoubt?"

"What can I do? All the reserves remaining at my disposal are 46 men in rear of the left flank, and about 50 behind the right, and even these I had difficulty in collecting after repulsing the assaults. Certainly 17 is few, but what can I do? One must keep some for contingencies."

In the course of a little time rifle firing broke out in the right redoubt. Although there was no immediate call for them, it was necessary to get the reserves ready for any contingency. The writer ran to rouse some men who were lying in a row by the road to the rear, which led from the commandant's blindage near the top of the hill.

"Here, get up quickly!"

"No, those will never get up," explained Tretyakov; "they are dead; the reserve is further on there."

Just then there ran out of the right redoubt what appeared to be a crowd of scared men. Tretyakov immediately ran to meet them, thinking that they must be retiring. But no, they were only bringing away a few of their own wounded and one Japanese; the bearers explained that the latter had been wounded, but fearing to show himself had lain patiently in the redoubt hiding among the dead, until he had been again wounded by a bursting shell, and had revealed himself by moving and crying out. He was taken on to the dressing station. Such an occurrence was rare by December, because both sides had taken to bayoneting their wounded enemies. There were several reasons for this. In the first place the combatants were embittered by the desperate nature of the fighting and the murderous effect of the weapons. Secondly, it was dangerous to leave a wounded enemy in the trench, as cases often occurred when wounded Japanese suddenly jumped up and dashed at the defenders, and sometimes bayoneted them; probably the Russians did the same; in a word, it was not safe to leave a wounded enemy in the trench, but there were neither time nor spare hands to take him to the dressing station; it was difficult enough to look after their own wounded, in fact sometimes a wounded man lay in the trench for hours. Thirdly, the Russian soldiers reasoned very simply in this way:—To take a man prisoner meant that he had to be fed and treated in hospital; but their own men had nothing to eat and there was no room for them in the hospitals. Besides this the Japanese were causing them to die of starvation, and without pity were destroying the hospitals, although the latter were marked by red cross flags, thus showing that they had neither pity for the Russians nor their wounded, so why should the latter pity them? Finally all the men were tired out and could hardly get through their actual work, let alone carrying away wounded enemies, against whom they were bitterly enraged.

And so this wounded Japanese who was taken down the hill to the dressing station was exceptionally fortunate. He evidently fell into good hands when the men were a little calmer than usual, or he would have

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taken his place among the dead, of whom there were a vast number on Visokaya Hill; almost at every stage there lay corpses or bits of corpses of either Russians or Japanese.

After going round the hill several times, the two Generals passed along the firing line on the saddle and then went down the enemy's side, and came back convinced that in that part very few Japanese remained opposite the Russian trenches. The riflemen and sailors stood in their places like heroes, repairing trenches and keeping up a fight with hand grenades.

Lieut. Fetter, of the mining company, superintended the engineering work on the saddle, as this was considerably weaker than the redoubts. Practically no defences remained here, and he was endeavouring to make at any rate a shallow trench with sand-bag parapet. Although the 11" shells were falling at the rate of one every five to six minutes, Fetter looked after his work with great coolness, standing completely in the open and paying no attention to them.

General Irman did not quit the hill till 6 a.m.

Fighting on Flat Hill.

Though the main Japanese attack on the 30th November was directed against Visokaya, yet they also attacked Flat Hill with great desperation.

They prepared the way for the attack with increased fire of artillery and mines. The mines had a terribly destructive effect; they blew the men to bits and scattered them with earth and stones in all directions. They absolutely wiped out the parapet of a trench, sometimes forming a breach as much as 10 paces in width, and they consequently had a great moral effect upon the men. Probably the Japanese had not very many of them, as they did not fire them very often, and, fortunately, they were not always successful in hitting the trench itself. The mine apparatus was on Long Hill, at 400 paces from the trenches on Flat Hill.

At 9.30 a.m. the Japanese carried out their attack and occupied the trenches of the 11th Company, 27th Regiment, and part of those of the 10th Company, 5th Regiment, and the Volunteer Party, 27th Regiment. The chief attack again fell on the unfortunate section with the dead ground in front of it. On this section, 20 paces in length, an especially heavy artillery fire was concentrated.

The gallant officers of the 10th Company, Staff-Capt. Astafiev and Lieut. Selikov, said that they would rather die than yield to the Japanese a single yard of their trench, and took all possible measures accordingly. Astafiev had volunteered for the war from the 28th Polotsk Infantry, and having taken over the 10th Company after Kinchow, distinguished himself with it on the 19th and 20th August at Angle Hill, where the company lost three-quarters of its strength. The 1st Half-Company lost practically all its men in the bayonet fighting and from artillery fire, but all the time gallantly held its ground, for which it gained the praise of General Kondratenko, who said that the companies of the 5th Regiment stood "like a rock." Kondratenko ordered all who remained of the 10th Company to be recommended for decorations, and that their names

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should be posted in their companies in letters of gold for all time. Astafiev was recommended for the Cross of St. George, but General Fok did not confirm this recommendation, but replaced it by some other award. Astafiev went round the trenches of his company before the fight and urged the men to maintain the high distinction they had won on Angle Hill; he foretold his own death in the fighting, and besought the men to fight as bravely after it as before, so as not to tarnish the glorious fame of their company.

The "unfortunate" section fell to the share of the 3rd Section, and here Astafiev collected the men who were most skilful at grenade throwing and ordered them to prevent the Japanese from collecting in the dead ground, and he also ordered that casualties in this section should be instantly replaced by men from the neighbouring sections.

When the increased bombardment commenced, both officers were in the "unfortunate" section, and Selikov was trying to cheer the men with jokes, so that in spite of heavy losses the company was in good spirits.

At 9 a.m., close to where these officers were observing, an 11" shell fell in the "unfortunate" section, and the scene of its bursting was marked by a heap of bodies. Sergt. Fedorov and several riflemen lay dead, and both officers were wounded and crushed, and each had one leg blown off. Astafiev was unconscious and did not speak again, but Selikov begged to be left alone, as anyhow he must soon die. The men lifted up both their heroes and carried them quickly out of the trench.

Astafiev died in the stretcher on the way to the dressing station, but Selikov (who was a Caucasian, transferred from the 25th Regiment) lived for some hours after his wounds had been dressed, and was able to press the hands of the men who had carried him to the dressing station in token of his thanks.

Hardly had they succeeded in removing the officers when the Japanese began to jump into the trench. The riflemen who remained there met them with their bayonets, and all perished in the unequal struggle, and the "unfortunate" section passed into the hands of the enemy.

On this, Sergt.-Major Evseiv lost his wits, and instead of taking over command of the company, ran to the commandant of the hill with a report of what had happened, and a hospital detachment, which was on the right of the 10th Company, abandoned part of their trenches without any apparent cause.

Under these circumstances disorder spread among the men of the 10th Company, and some moved to the right along the trench with the intention of retiring, but Sergt. Kominar, commanding the 1st Section, rushed to meet them, and stopped and calmed them. Then collecting a few resolute volunteers he led them forward, and by skilful grenade throwing compelled the Japanese to fall back; he could not completely drive them out, as by that time he had only 30 men left, with whom to defend from the front a length of 200 paces of the trench.

Much in the same way the Japanese obtained success in two or three other places, and Flat Hill was evidently in a very critical state; but its commandant, Lieut.-Colonel Budyanski, was brave, energetic, and ready in expedients, and knew his work thoroughly. Collecting all the reserves

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whom he could lay his hand on, he forthwith launched them against the Japanese, and after a desperate struggle, which continued with varying fortune till 11.30 a.m., he finally drove them back, and everywhere re-occupied his original positions.

At 11.50 he reported that, by the terrible bombardment which had continued since dawn, all his trenches were destroyed and a very large number of his men killed; in the Stony Redoubt as many as half the garrison had fallen; that the Japanese had made an attack and had occupied part of his trenches, but that by his dispositions they had been beaten off, and all the trenches were once again in his possession; and that now he could see that the enemy were concentrating their forces against the centre of Visokaya Hill.

After midday the Japanese made no serious attack on Flat Hill, but limited themselves to demonstrations and artillery bombardment. Lieut.-Colonel Budyanski, who since the 27th November had repulsed such a number of Japanese attacks, became famous throughout the garrison, and was recommended for the Order of St. George, with which he was afterwards deservedly rewarded.

1st December.—The Japanese, as usual, increased their artillery fire at dawn, and their infantry recommenced their attacks, but with far less energy than on the previous day. Their tone had notably weakened. They advanced to the attack, not in large masses, but in small parties of about 50 men each, and these attacks lacked the *élan* and persistency of the day before. What generally happened was that some 50 men with loud cries would climb out of their trenches and make a dash up the hill; the Russians would overwhelm them with grenades and rifle fire, and they would fall back; after a little time they would repeat the practice. In this way the defenders had to be constantly on the alert, and as they were exposed to a powerful artillery fire the whole time, their losses were considerable. Unfortunately no count was kept of the number of shells which were fired on this day against the hill, but it must have been fully 800, and possibly 1,000.

Lieut. Erofiev reported to the 5th Regiment Staff, from Pigeon Bay, that about two regiments of infantry were seen to move from Visokaya to Angle Hill, and on towards Louisa Bay; that there remained enough men on Visokaya to keep a few moving about in the Japanese saps and to man the lower parallels, though not so strongly as on the day before, while of the columns which overnight had been noticed climbing the hill, not a sign was to be seen.

As Erofiev could obtain a good view of the side of Visokaya which was being attacked, his information was very accurate and valuable, and on this occasion it was decidedly consoling (see *Fig.* 7, which is a sample of the sketches which accompanied Erofiev's reports).

At about midday the Staff of the Land Defence reported that about two battalions of Japanese were moving over towards the left flank. Two regiments going away at dawn, two battalions coming in the forenoon. Evidently the enemy were replacing the troops who were exhausted in the fighting. They too were worn out, which was satisfactory!

If one considers that two regiments had been relieved and that

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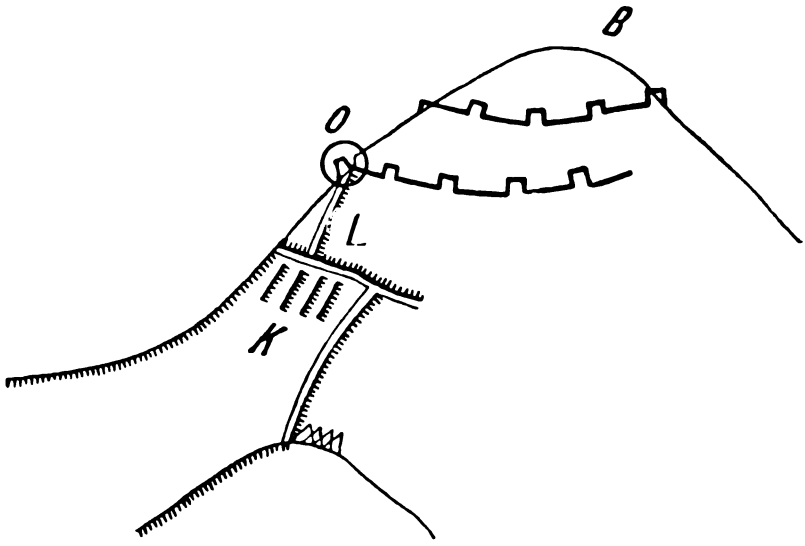

FIG. 7.—*View of Visokaya Hill from Pigeon Bay, 1st December, at dawn. Eye-sketched. Lent by Lieut.-Colonel Gobyato.*

O.—Shows site of blindage occupied by the Japanese on 28th November.
K.—Traverses erected by the Japanese to shelter their reserves from artillery fire from Pigeon Bay.
L.—Japanese communication trench, connecting their sap with the captured portion of the Ring Trench.

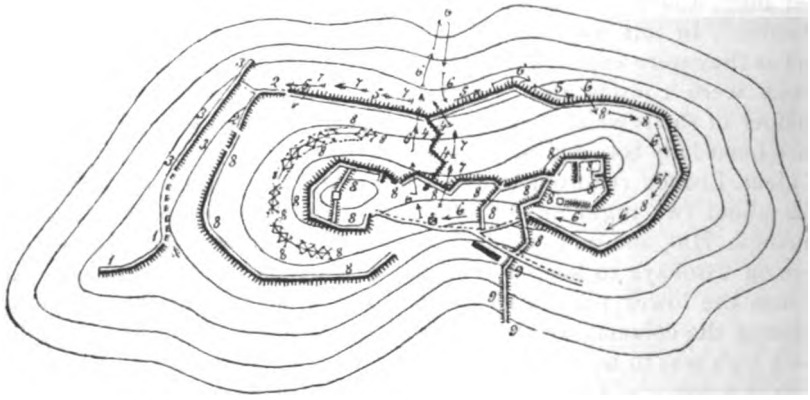

FIG. 8.—*Plan of Visokaya Hill, showing the events of 1st to 4th December*, 1904.

(1). Trench excavated by the Japanese for correcting their fire on the fleet and the town.
(2). Portion of Ring Trench captured by Japanese. The sortie before dawn on the 5th December was directed against this.
(3). Japanese sap.
(4). Demolished portion of covered communication trench.
(5). Demolished and unoccupied portion of Ring Trench.
(6). Route of first reconnaissance on night 2nd—3rd December.
(7). Route of second reconnaissance on same night.
(8). Trenches, communications, and obstacles occupied and repaired by the Russians.
(9). New communication trench constructed by Ensign Ermakov in the nights 2nd and 3rd December.

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sufficient troops still remained, one may assume that the hill had been attacked by three regiments; on the Russian side there were never present more than 500 men, and sometimes only 300. It is true that casualties were constantly being replaced from the reserves, but these casualties were caused by the Japanese artillery, and if the reserves are written off against the Japanese artillery, it remains that the 500 wearied, half-starved Russians had been opposed to three regiments of Japanese infantry. As each regiment numbered from 2,500 to 3,000 men, it will be seen that the proportion against the defenders was about 20 to 1.

And these overwhelming masses by continuous fighting during the day succeeded in gaining the very summit of the hill, only to fall back during the night before the charge of two, three, or four fresh Russian companies, which had been meanwhile brought up from the reserve. It was noticed that the Japanese could not as a rule withstand the Russian bayonet charges, and for these the night was most suitable.

The admirers of Japanese bravery may explain their ill-success by the maxim that it is much more difficult to attack a hill than to defend it; but how can they explain that the enormous forces of the Japanese could not hold ground *already taken*, and were driven back by mere handfuls of Russian soldiers?

Even Tretyakov, self-sacrificing, gallant, experienced, and energetic though he was, could not work miracles. In the opinion of the writer, attentive criticism of the actions of both combatants at Port Arthur does not confirm all the praise which has been lavished upon the Japanese.

Their Generals had great perseverance, but the quality of their troops was not at all superior to that of the Russians. In Manchuria the Japanese with weaker forces captured the positions because the Russians fell back before them by order. All were struck with their discipline, order, courage, etc. The same Japanese fell back themselves several times at Port Arthur, while at Visokaya, where they met a fine garrison under the direction of a first-rate commander, their ill-success was extraordinary—extraordinary because, after converting the position into a heap of ruins, and with enormous preponderance of artillery and infantry, they could not capture the hill, in fact they even retired before mere handfuls of its defenders.

No! The Japanese troops are excellent, but nothing exceptional, nothing invincible, and they do not excel the Russians. They are not exempt from errors and disorders. Everything depends on the troops with whom they have to deal. Three regiments were so exhausted in the struggle with the wearied handful of Russians that it had become necessary to give them relief and rest. Surely this was not victory!

In a report by Lieut.-Colonel Seifulin, who had temporarily replaced Tretyakov on Visokaya Hill, it was stated that at about 3 p.m. a small party of Japanese, numbering 25 men, suddenly climbed out of their sap and running up to the parapet of the left redoubt opened an irregular rifle fire, and at the same time made fast some long ribbons of paper, which being blown out by the wind disclosed both the line of the parapet and also that of the damaged covered communication trench down the hill.

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The party was soon driven back by rifle fire, but the Japanese artillery began shelling the spot where the ribbons were blowing about, and struck down several railway labourers and riflemen who were there. Colonel Seifulin ordered the ribbons to be taken away, and when this was done the previous conditions of fire were re-established. Evidently the Japanese had endeavoured to point out to their artillery points at which further demolition was required.

The Japanese, who were making an outwork on Visokaya in front of the Russian trenches, worked hard at it all day, and in order to conceal the working parties they lit up wood fires in places so chosen that the smoke driven by the wind concealed them from view. They probably threw damped rags into the fire, at any rate whatever they used produced a very thick smoke, which effectually concealed their work. General Tretyakov correctly gauged their intention and ordered the men to fire into the smoke, but as the actual position of the working parties could not be seen, the random firing probably did very little harm.

At about 3 p.m. the newly-appointed commandant of Visokaya, Capt. A. I. Veselovsky, with his company, the 5th, 26th Regiment, set out for the hill. On his way he was laughing and making jokes, and his men, taking their cue from their gallant commander, were in a state of cheery good-humour. "With such a company as ours," said the men, "no place is to be dreaded!" Their sincere, light-hearted, and honest tone inspired the conviction that in that company there was no injustice, no discontented man, but a strong bond of unity between the commander and his subordinates.

On this day the Japanese also carried out small attacks against Flat Hill, and in one place, as usual near the "unfortunate" section, they had a certain amount of success. The Hospital Detachment, who happened to be there, by moving towards the left evacuated the bays between three traverses, and the Japanese burst into these and thus secured an entrance into the Russian works. On hearing of this Capt. Baron Geikin began calling for volunteers to drive them out. But among the hospital men no volunteers came forward, and he had to turn to the 12th Company, 5th Regiment, who were alongside, and who at that time, including the wounded remaining in the ranks, numbered in all 12 men; he secured three, Sergt. Zakharov, Rifleman Ryabukhin, and Town Guard Tiushev. These fearless men, throwing grenades into the bays held by the Japanese, rushed forward, followed by Geikin and the hospital men. Communication with the neighbouring company was re-established, because few Japanese were left.

Zakharov, Tiushev, and Ryabukhin were taken by Geikin before the commandant, Budyansky, who thanked them, and begged for them decorations of the Military Order. Zakharov had already greatly distinguished himself in the preceding fighting, and had performed many gallant deeds, of which three were especially brilliant, namely, on 28th November guiding the volunteers who drove the Japanese from the "unfortunate" section, on the 30th November, after being wounded in the knee, remaining in the ranks, and on the 1st December volunteering to restore connection in the trench. In all, he was recommended at various

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times for four grades of the Military Order and for promotion to sub-lieutenant; but he was promoted only to the rank of ensign, and received no other grade of the Military Order.

General Kondratenko was able to replace Tretyakov by Lieut.-Colonel Organov, 26th Regiment, in order to give him leisure to rest and have his wound dressed; but it was already evening and quite dark before the relief had been carried out, and Tretyakov rode down from the hill to the 5th Regiment Headquarters. Kondratenko, who had spent the whole day there, asked him many questions, and deliberated with him for many hours as to the fate of the hill, and not till after midnight did the former ride off to his quarters.

After his departure Dr. Troitsky inspected Tretyakov's wound, and found that he had a splinter in his back and that the wound was beginning to fester, and advised him to go at once to hospital to be operated upon; but he was exceedingly tired and hardly understood what the doctor was saying, and forthwith fell asleep.

The riflemen on the hill meanwhile did their best to clear and repair the trenches and blindages which were wrecked and encumbered with corpses, but the work made little progress owing to the heavy artillery fire, which was destroying not only the works, but even the very hill itself.

2nd December.—During the night the enemy kept up an occasional artillery fire on the hill. At dawn this was increased, and the attacks by small parties were renewed, the events of the previous day being generally repeated. No serious attack was made, and no change took place in the condition of the defenders.

From Louisa Bay it was seen that the Japanese were moving about in the villages; under Visokaya increased energy was being put into the work of strengthening the defences; every sap and traverse was adorned with a fresh layer of sand-bags, which were being brought up with this object in large numbers to the foot of the hill, and unloaded just above the lower parallels.

The Russians also increased their efforts at repairing their ruined works and making new trenches. It was decided first to put the trenches into good order, and afterwards to start repairing and unearthing the blindages. At this time Lieut.-Colonel Organov was director, and Capt. Veselovski was commandant, both belonging to the 26th Regiment.

Tretyakov, after spending the night at the 5th Regiment Headquarters, went at 10 a.m. to the 9th Hospital, where Doctor Krzhivets dressed and bandaged his wound, but did not remove the splinter, as he did not consider it harmful.

Kondratenko had returned to the 5th Regiment Headquarters at dawn, and awaited with impatience the return of General Tretyakov, which occurred at about 2 p.m. Taking him by the hand, Kondratenko overwhelmed him with enquiries about his health and about Visokaya Hill, and they continued to consult together until circumstances separated them, as it turned out, for ever.

It was proposed to give Tretyakov rest for two days, but at about 3.30 p.m. Lieut.-Colonel Organov reported that the firing on Visokaya

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was increasing and that he anticipated an assault, and as he himself was ill-acquainted with the hill and how to defend it with small forces, he begged that either Tretyakov or Irman, who were well acquainted with it, would ride up there to give him any necessary information and advice on the spot.

Organov was a very efficient staff officer; though brave, he did not feel confident that he could manage, in case of assault, the complicated problem of the defence of Visokaya Hill, and so he frankly asked men, whom he knew to be capable of it, to direct him in this difficult path.

Tretyakov at once got ready, and at 3.45 p.m. mounted his horse and gallopped off to the hill.

At 4 p.m. ten separate 11" shells fell in the Tea Ravine, near the artillery barracks, where the reserve companies were quartered. This circumstance showed clearly that the Japanese could see well the whole Tea Ravine, and could correct their fire perfectly from the outwork which they had been at work upon the day before. As it was undesirable to expose the reserves to such danger, they were ordered to be removed from the Tea Ravine, and orders were also given to look to the safety of the 5th Regiment Headquarters, as the building was very exposed. But it was impossible to induce any of the staff to move at any time, because in the ravine they were near Visokaya Hill, could see what was going on there, and were consequently always in touch with their work. Therefore they contented themselves with closely veiling by night only the windows which looked towards the hill.

On arriving at Visokaya, Tretyakov found that Organov's fears were without foundation, but he remained on the hill, and decided during the night to find out accurately where the enemy was posted and in what force. For this enterprise more volunteers came forward than were required. Four men were selected by casting lots, and these, descending by the saddle on the far side of the hill, got as far as the trench which had been originally held, but which it had been decided on the 2nd could no longer be occupied.

It should be mentioned that the covered communication trench having been demolished and all movement along it stopped, it became impossible to send assistance to the troops who were kept in this western portion of the ring trench, and consequently they all fell victims, at first to artillery fire and later in the unequal bayonet fighting, so that on both the 30th November and the 1st December the Japanese captured the trench with little difficulty. Seeing this, General Tretyakov, in order to save himself from devoting a fresh company each day to useless destruction, decided on the 30th November to occupy this portion no more, and no harm had resulted thereby. The Japanese apparently did not occupy it either.

The reconnaissance party found the trench to be a complete wreck, the blindages broken in and presenting to view nothing but heaps of stones, splinters of beams and planks, torn sacks and other rubbish, mixed with fragments of human bodies.

They crossed this trench and went on down until they came to the Japanese parallel, which at this point they found to be empty. Wishing to decide whether the whole parallel was unoccupied or only a part of it,

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they turned to the right along it, but the Japanese began firing, and after this they could ascertain nothing accurately. Thereupon they climbed up again and went round the whole of the right half of the hill in the demolished trench without finding any Japanese. All four received decorations of the Military Order; they were all sailors belonging to Lieut. Lavrov's aeronaut detachment.

During the nights of the 2nd—3rd, and 3rd—4th December, Ensign Ermakov was employed in making a communication trench up the eastern slope of Visokaya. The object of this trench was to protect reinforcements going up the hill from the Japanese artillery posted in the village Shiushin, and striking Visokaya Hill in rear from the north-east. Thanks to Ermakov's energy and the united efforts of Lavrov's aeronauts, a trench 7′ in depth was completed in the course of these two nights.

3rd December.—Having got such encouraging results from the reconnaissance on the right half of the hill, Tretyakov sent another four men to explore the left. Of this party none came back, a fact which was taken to show the close proximity of the enemy on the left flank, in trenches under the redoubt, though probably not in large numbers.

Wishing to relieve themselves of such undesirable neighbours, Tretyakov and Veselovsky decided to drive them out, and with this object they organized a small sortie. General Irman, who came up in the night to enquire into the state of affairs, approved of the undertaking, but, although a greater amount of success was to be expected from a large sortie, he was of opinion that it should be limited to a small one. This was because it would have been necessary to ask for reinforcements, and also for permission from the Commander-in-Chief for a large sortie, and even if permission were granted and reinforcements collected, the night would be past and all hope of success would have been lost, since in daylight no advance was possible, in fact it was barely possible to hold on to what they had.

The volunteers selected for the sortie took with them a good number of grenades, and creeping near began throwing them at the Japanese, who fell back raising furious cries and groans; the Russians advanced, but strong reinforcements for the enemy coming up the hill prevented them from completing their task. Yet not being thrown into disorder by this, and in spite of the overwhelming number of the enemy, they decided to make a fight of it, and met them with grenades and rapid rifle fire; the Japanese replied with the like, and about 5.30 to 6 a.m. a sharp firing broke out. The enemy were disturbed and, an hour earlier than usual, opened a terrific fire on Visokaya from all their artillery.

It is unnecessary to say that under such conditions the volunteers could do nothing, but had to retire suffering inconsiderable loss. But, in spite of its ill-success, this sortie was of very great value, as it disclosed exactly the position and strength of the enemy. It showed that the Japanese on Visokaya Hill were posted in great strength and complete readiness for action. It showed that from day to day and hour to hour it was necessary to await a desperate attack. But in connection with this sortie occurred the heaviest loss suffered by the Russians.

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Tretyakov and Veselovsky were still uncertain of the results of the sortie, when between 5.30 and 6 there commenced a hot firing on both sides on the left flank of Visokaya. They at once stood up in their observation post and got ready for emergencies, but before they had time to ascertain what was going on a storm of every possible nature of shells burst upon the hill. In an instant the hill was in disorder—there was a pause. The reserves quickly ran up and dragged away the wounded who were near them. Another moment, and a huge shell had converted the whole observation post into a heap of killed and wounded. As the shell reached the hill, it struck the head of Capt. Veselovsky, carrying away the upper half, and sprinkled those near, and especially General Tretyakov, with his brains. Then striking the rock it burst with a crash and caused a terrific vibration in the air. Splinters and stones struck all those standing near and converted them into a heap of killed and wounded. In this heap Tretyakov lay insensible, and he was at once dragged down the hill, placed on a stretcher, and carried to the Red Cross Hospital. The distressing news spread on all sides like lightning. When he was carried past the headquarters, 5th Regiment, he presented a ghastly spectacle. His pale inanimate face was covered with congealing blood and dust, his hands and clothing were blood-stained, and his grey coat was bespattered with brains. The bearers said that he was wounded in the head, and although he opened his eyes, he evidently recognized no one. All who saw him felt that his wound was mortal, and they went back to their work with heavy hearts, feeling that they could now bid farewell to Visokaya Hill.

In fact the loss of Tretyakov was acutely felt by the whole garrison. His name was associated with success; both his seniors and his juniors put trust in his capacity, and in him was their hope. Both hope and trust were never disappointed, but every time strengthened.

From the evening of the 28th November, when he made himself famous by retrieving the fortune on Visokaya Hill, his name was everywhere mentioned with respect and pride. Since that date his series of brilliant deeds performed before the eyes of the rank and file had further enhanced his reputation. In fact among the men he was looked upon as a demi-god, and the preservation of Visokaya Hill with such small numbers, in spite of the overwhelming artillery fire and preponderating numbers of the enemy, was attributed to his supernatural influence. This idea was developed automatically by the circumstances, in combination with the talent and character of this rare man. As an example of this, when most of the original officers had been killed and those who replaced them were entirely ignorant of the position, it became important to show the men that they were not uncared for, and consequently it was necessary to constantly visit and encourage them. This was naturally the work of their officers, but on Visokaya Tretyakov himself led them in their attacks, went round their trenches, giving advice, orders, and information as to the state of affairs in neighbouring sections, and in his quiet way, by kind words and by his presence at the most dangerous points, not only cheered the men and confirmed in them a sure trust in future success, but also

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inspired in them resolution and a thirst to take part in the most heroic enterprises. The men so venerated him that they prayed to God for his protection, and his fame extended beyond his own justly proud regiment, and beyond the defenders of the hill, to the whole garrison, and even to the inhabitants of Port Arthur. Tales of his exploits went from mouth to mouth and frequently passed into the realms of romance. Yet nothing was too wonderful to be believed by the men, who did not doubt that the hill was preserved by his influence alone, and felt such affection for him that they all, and especially those of the 5th Regiment, wept bitterly at his loss.

In order to truely estimate the value of his services on Visokaya Hill, one must discard all fables and restrict oneself to the bare facts. Tretyakov arrived on the hill at a critical moment, when the greater part of it was in the hands of the Japanese, re-captured it, and for 5½ days repulsed endless attacks without losing anything that could be considered a key to the position. From shortage of officers, he had to do, besides his own duties, all kinds of subordinate work, such as practically leading each company in attack, directing the work of the sappers, visiting rounds, encouraging the men, etc. In spite of fatigue he never had time for rest. On the 2nd, in spite of his wound, he appreciated the urgency of the situation sufficiently to remain at his post without asking for relief or rest.

In the fighting he displayed the qualities of courage, energy, activity, skill in influencing the men, and, from his engineering training, genius for putting his knowledge of fortification into practice. For every critical complication that occurred he always found some solution, and the more hopeless the appearances the greater were his coolness, activity, and courage. Only with the help of such qualities could the five major attacks (28th November one, 29th November two, 30th November two) by overwhelming numbers of the enemy have been so brilliantly repulsed.

His exploits did not pass unnoticed by the enemy, and the deeds of the 5th Regiment and its commander were frequently recorded in their gazettes. On the 6th January, after the fall of Port Arthur, when towards evening the 5th Regiment arrived at the 19th Verst ready to be entrained for Dalny, a Japanese major, who spoke Russian well, made many enquiries as to the whereabouts of the 5th Regiment, and going up to the officers spoke in great praise of the whole Port Arthur garrison, and especially of the 5th Regiment. In conclusion he begged earnestly to be presented to "the very gallant commander of the regiment." The Major's desire was granted, and he acknowledged himself very flattered by the acquaintance of such a brave Russian commander. At Nagasaki a deputation waited on General Tretyakov, and after many expressions of praise and enthusiasm, produced a gazette printed in their own language, in which his exploits were recorded.

General Kondratenko was greatly afflicted at the news of Tretyakov having been wounded. He said that he was "invaluable" and "impossible to replace," and sent Dr. Troitsky to him with the following

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message:—"Give Nicholas Alexandrovich my deepest thanks for his valiant defence of Visokaya Hill, and express my sincere sorrow for his being wounded; say that a very great reward awaits him, and wish him a speedy recovery, for he is very necessary to us." It may be here mentioned that, in company with Stessel, Smirnov, and Irman, he afterwards received the 3rd Class of the Order of St. George.

Visokaya Hill having by these casualties been left almost without commanders, Lieut.-Colonel Seifulin volunteered to go there, and having received the sanction of Generals Irman and Kondratenko, set forth immediately.

The Japanese artillery were shelling the hill with somewhat greater vigour than on the previous day, and their infantry continued to alarm the garrison with attacks made by small parties, but no resolute assault was attempted. They continued to push forward and worked hard at their entrenchments. The Russians also worked indefatigably at repairing their defences, but both sides also found time for the interchange of rifle fire and grenades.

And so the Japanese rested for yet a third day, but the wearied Russians carried on the fight without relief or rest. In the majority of cases a company was told off to a trench, and remained in it until all were either killed or wounded. The men knew this, and it was very trying to their *morale*.

But for the successful defence of the hill efficient and not exhausted men were essential. This Kondratenko recognized, and therefore he sought for an arrangement by which companies could be relieved every two days. At the same time he made up his mind that the garrison of Visokaya should consist solely of companies of the 5th Regiment. This decision is intelligible when it is understood that the companies of the 5th Regiment were receiving praise at all hands, and in view of the probability that after their rest the Japanese would renew their more powerful attacks, it was necessary to be prepared to meet them with the best and most trustworthy troops of the garrison.

But a very material obstacle impeded the carrying out of this intention. All the companies of the 5th Regiment had carried on without intermission the fights on Visokaya, Flat, and False Hills, and were tired out, besides having suffered enormous losses. Some of them numbered only 20 men each, including the wounded, who had remained in the ranks. Besides this, most of the officers had fallen. But the desire to form the garrison of the hill from companies of the 5th Regiment was so great, the idea so tempting, that Kondratenko decided to bring these companies up to strength, and as there were no reservists available, he did this partly with hospital men and partly with a draft of 213 men of the 28th Regiment, which was sent up for this purpose, under Sub-Lieutenant Gudkov. This combination at first sight appeared very suitable, but complaints had been made against the hospital detachments, and the stoical, trusty companies of the 5th Regiment would have preferred to have been made up without them.

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Orders were also given to repair the shortage of officers by appointing the best of the 5th Regiment N.C.O.'s as acting ensigns.

In this way about 600 men, chiefly hospital men, were drafted into these 11 companies. About 20 of the best N.C.O.'s were made ensigns, and thus the regiment again possessed officers and an average of 100 men per company.

When distributing the hospital and 28th Regiment men, the companies were brought up to approximately the uniform strength of 100 each. Where more of the original men remained the hospital men were in a minority, but in the companies which numbered only 20 of the original men the result was not satisfactory. The hospital men did not serve willingly under the officers, and under ensigns they worked still less willingly. Where there were comparatively few of them they were influenced by the majority, but in the companies where they were four times the stronger party they were difficult to manage.

The 2nd, 3rd, 4th, and 6th Companies were the first brought down from the hill, and when they had been made up to strength, they were sent to the barracks to rest.

Kondratenko personally met the decimated companies, and shook hands with, and in some cases kissed the newly-appointed ensigns, praying the men to love and obey their new commanders. He cordially thanked the men for their courage and congratulated those who had distinguished themselves, decorating 10 men in each company until the supply of crosses was exhausted, and when there were no more left, noting down names for future rewards.

About midday Dr. Feodor Semenvich Troitsky arrived with the joyful news that Tretyakov's wound was not serious. Everyone rejoiced at the good news. On further enquiry, he explained that the General was wounded in the neck, eyes, face, back, badly bruised by the "wind" and by stones, and crushed by the heap of killed and wounded who fell on him.

Besides the wounding of their commander, the 3rd December brought further irreparable losses to the 5th Regiment, as on that day both Capt. Stempnevski I. and Staff-Capt. Belozerov died of their wounds.

Stempnevski had on the 30th November been wounded by several splinters; one hit him in the back and lodged in his lung. In the hospital his wound was probed, but the splinter was not found, and he was unnecessarily exhausted. He gave every hope of recovery; on the evening of the 19th December he took a bath, got into bed almost unaided, and then lay asleep. During the night he began to breathe heavily, and at dawn was gasping for breath, and then died quietly.

Belozerov was wounded on the 29th November by a splinter from an 11" shell in the head, which formed a large wound, but his brain was little damaged; as he lay in the 9th Hospital he at times came to himself and talked. His comrades were delighted and hoped that he would recover, but for this he required good nursing, and there was none at that time in the hospitals. A very limited number of servants and assistant surgeons had been left, and no Sisters of Mercy were obtainable,

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the rest of the attendants having been drawn from the ranks. For this reason Belozerov did not get good nursing. He soon became delirious, and in one period of delirium, falling out of bed on to the floor, he struck his head and did not recover consciousness, but died in about two hours.

As a means of repulsing the threatened assaults, Kondratenko asked two naval officers to make an attempt to establish on Visokaya Hill a mining apparatus, and to fire from it into the Japanese saps. On the evening of the 3rd December these officers and a few sailors with the apparatus went to the hill and long searched for a convenient spot sheltered from the Japanese shells on which to put it up; but they were finally convinced that no such spot existed, and were obliged to return without carrying out their object.

(*To be continued*).

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NOTICES OF MAGAZINES.

Revue Militaire des Armées Étrangères.

August, 1909.

Military News from Various Countries.—*Belgium.*—A new dirigible is being built from plans made by the head of the ballooning department, and thus at the end of the year Belgium will have two military dirigibles.

A new Field Artillery Training Manual has been temporarily edited; the main points emphasized in it are:—(1), The value of initiative to all ranks; (2), that troops should be economized at the beginning of the fight, most of the batteries being kept in positions of observation, and above all in positions of readiness; (3), the importance of sudden "rafales," and (4), the utility of a counter-attack made by the guns at unexpected moments.

Austria.—A new infantry bullet is just being experimented with; it is so constructed that on striking the ground a cap sets fire to some smoke composition in it, and thus enables the position where it strikes to be easily located.

Germany.—Pay of Officers.—A new law concerning the pay of Government officials was passed by the Reichstag in July, 1909. From it are taken the following extracts, which refer to the pay of officers and N.C.O.'s; the new rates take effect from the 1st April, 1908:—

Subalterns— 1 to 3 years' service	£75	per annum.
„ 4 to 6 „	£85	„
„ 7 to 9 „	£95	„
„ 10 to 12 „	£105	„
„ from 13 „	£120	„
Company, squadron, and battery commanders—1 to 4 years as such	£170	„
5 to 8 years as such	£230	„
after 9 years	£255	„
Majors and lieut.-colonels	£328	„
Officers commanding regiments	£439	„
Brigade commanders	£513	„
Divisional commanders	£678	„

These sums do not include allowances, and lodging allowance is given, and varies from £15 per annum in small towns to £28 per annum in Berlin.

The fact that an officer is senior enough to get a higher rate of pay does not prevent him from *not* getting it, should he have been condemned by the Emperor to forfeit it for conduct unbecoming to an officer.

The German Association of Automobile Builders, in conjunction with the War Office and the Lines of Communication Technical Committee,

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have fixed a standard size for the wheels of heavy motor cars, so that the wheels of all army vehicles may be interchangeable.

Russia.—On the 22nd July, 1909, £8,060 were granted for dirigible balloons. From 1910 the dirigibles will be paid for out of the Army Estimates.

Turkey.—The "High Commission of Military Inspections," which was reorganized after the revolution of 1908, has once more been altered. Its name has been changed from "Military Affairs Council" to "Chourai-Asker," *i.e.*, "Superior Military Council." It remains under the War Minister, who is its president, but now also includes as members the Inspector-General of the 1st, 2nd, and 3rd Army Corps, the Inspectors-General of Artillery and Cavalry of those corps, the 1st Army Corps Commander, and the Chief of the General Staff.

This body studies all questions concerning the military reorganization of the Empire.

September, 1909.

MILITARY NEWS OF DIFFERENT COUNTRIES.—*Denmark.*—Reorganization of the army.

The army is organized in 2 army corps.

The different arms are organized as follows:—

Infantry.—2 Brigades of 2 regiments; each regiment is composed of 2 regular and 2 reserve battalions. 5 regular regiments of 4 battalions, 1 regular regiment of 2 battalions, the Guard—1 regular and 1 reserve battalion, 3 reserve regiments of 4 battalions. Total, 31 regular and 21 reserve battalions; 4 companies to each battalion. The increase due to the new organization is 4 battalions.

Cavalry.—2 regular regiments of 3 squadrons each, 2 regiments of 2 regular and 1 reserve squadron each. Total, 12 squadrons, instead of 15 as before.

Field Artillery.—2 regiments of 2 brigades each, 2 independent brigades. Each brigade has 4 batteries. Total, 24 batteries, instead of 16 as previously.

Coast Artillery.—12 regular batteries, 6 reserve batteries. Total, 18 batteries. (No alterations).

Engineers.—1 regiment of 10 regular and 2 reserve companies, 2 headquarter sections. Total, 12 companies, instead of 9.

The army is supplied in recruits as follows:—Infantry—8,000 recruits for 165 days. Guard—272 men for 150 days. Cavalry—380 men for 200 days. Train (A.S.C.)—270 men for 60 days. Field artillery—792 men, the drivers for 1 year, gunners 280 days. Coast artillery—800 men for 1 year. Engineers—300 men for 210 days. Technical services—60 men for 13 months. Supply department—50 men for 125 days. Army Medical Corps—120 men for 230 days.

Germany.—Aeronautics.—(1). Dirigibles on the Non-Rigid System.—No. 3 Parseval, after its preliminary trials, has been increased to the following dimensions:—Length, 70 metres; diameter, 12·3 metres; capacity, 6,700 cubic metres. Two 100-H.P. motors fixed to the car cause two propellers of 4 metres in diameter to revolve. There is an

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arrangement for travelling backwards, which is of the greatest use in coming to earth. The car can carry 6 to 8 passengers besides the crew. A new 3,300-cubic metre Parseval is soon to be sent up by the German Aero-Club.

A balloon belonging to the Rhine-Westphalian Motor Club will soon complete its trials. Capacity, 3,000 cubic metres; length, 54 metres; diameter, 10 metres; motor (one), 150-H.P. The speciality of this machine is its arrangement for preventing the contraction of the gas in cold air.

The "Clouth" balloon length 40 metres, diameter 8 metres, and capacity 1,700 cubic metres, is intended for sport, and was tried at the Frankfort Exhibition.

(2). Semi-Rigid System.—No. 2 Gross completed its trials last April and is actually in use. No 3 Gross has just been finished, and its trials are to begin at once. It is larger than Nos. 1 and 2; length, 86 metres; lifting power, 2,000 kilogrammes; 4 motors of 75-H.P. each, actuating 4 four-bladed propellers fixed to the sides of the car.

(3). The Rigid System.—Nos. 1 and 2 Zeppelins belong to the War Department, and are kept at Cologne and Metz respectively. No. 3 Zeppelin at Berlin is the same size as No. 2, but has two motors of 150-H.P. each instead of 110-H.P., and consequently a velocity of 14·5 metres per second instead of 13. Its propellers have two blades instead of three, and power is transmitted to the propellers by means of steel bands, which do not however appear to be very satisfactory. No. 4 Zeppelin is soon to be begun, and a Schutte dirigible of a capacity of 19,000 cubic metres and 500 to 600-H.P. is being built.

(4). Sheds for Dirigibles.—There are sheds at Metz, Cologne, Biesdorf (near Berlin), and at Leichlingen, but of these, the first two only are military. A new portable shed for use in the field, 120 metres long, 20 broad, and 25 high, which can be put up in 12 hours, has been acquired. There are several other sheds to be erected in important towns such as Kiel, Strasburg, and Stuttgart.

(5). Principal Experiments and Flights.—(*a*). In May the Parseval No. 2 attained a height of 1,200 metres.

(*b*). Several experiments have been carried out with the Gross machines as to the possibility of communicating with a dirigible by means of "wireless"; the results however have not been made public.

(*c*). The Zeppelins have accomplished four very remarkable journeys. These are, however, too well known to be described in this paper.

(6). Military Ballooning.—At present (1st September, 1909) the German War Department is in possession of six dirigibles, viz., three Gross, No. 2 Parseval, and Nos. 1 and 2 Zeppelins; it will very soon possess a 7th—No. 3 Gross. These ships are stationed at Metz, Cologne, and Berlin. Nos. 2 Zeppelin and Gross seem to possess the faculties of being able to land anywhere, and of having a wide zone of action.

It is most probable that the War Department is making arrangements for using private dirigibles on the same terms as for private motor cars in time of war.

It is undeniable that the German dirigibles have attained such a state of perfection as to render real assistance on active service by making both strategical and tactical reconnaissances.

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Technical Academy of Berlin.—The course at this academy has been increased to four years. There are three divisions—those of the armament, engineer services, and of the lines of communication department.

Most officers will however only remain at the Academy for two years, the advanced course being given to only about one-third of the class originally admitted (50 out of 166).

Six officers of the advanced course will, after their fourth year, be granted leave to make an instructional tour of 4 to 12 weeks in Europe or the United States.

Italy.—The following modifications have been made in the Italian Army:—(1). The number of Alpine regiments has been increased by one; (2), the number of cavalry regiments has been increased by five, and (3), the number of mountain artillery regiments has been increased by one, *i.e.*, by 12 batteries.

A. H. SCOTT.

RIVISTA DI ARTIGLIERIA E GENIO.

A description, by Major-General P. Spaccomela, of the various kinds of detonating fuzes, is given in the September number of this review. Fuzes were formerly manufactured in France with a core of guncotton contained in tin or leaden tubes. The diameter of the tubes was 4 m.m., the velocity of detonation from 5 to 6 k.m. per second if the tube was of tin, and of 4 k.m. if of lead.

The difficulty of manufacturing these tubes induced the French Army to substitute another kind, having a core of mélinite contained in a tin tube, with a velocity of detonation of about 7 k.m. per second.

In Austria, General Hess proposes to adopt a detonating fuze with a core of fulminate of mercury. This fuze has the drawback of being too sensitive.

Nobel, in 1888, proposed a fuze with a core composed of a mixture of camphorated gelatine, chlorate of potash, ferrocyanide of potash, and nitrocellulose.

A detonating fuze of picric acid enclosed in a tube of pure tin is now in use in the Italian Army, with a velocity of about 6,000 m. per second.

All these fuzes should be used as detonating fuzes only, with the exception of the guncotton one, which can also be used as a fuze of slow combustion, but with very uncertain results.

The great object now of the Italian Army is to find a fuze which combines the property of slow combustion with that of detonation. Preference is given to ballistite, an explosive which is manufactured in Italy, and numerous trials have been made to obtain satisfactory results. Fuzes made with this substance can be exploded either in the air or under water. When however used for slow combustion they will not always burn under water.

Although the fuzes of ballistite have given good results, especially when detonated, the manufacture of the explosive itself is troublesome,

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as it requires to be reduced to a fine powder. This is a long operation, and one which causes great inconvenience, as the men employed are subject to bad headaches, especially when the work is prolonged and carried on in enclosed places. Great care is also required in filling the leaden tubes, as unless completely filled, the detonation is arrested at the point where there is discontinuity in the core.

Long and numerous trials have been made to produce a fuze with a core of ballistite and powder, in a tube of tin, which will either burn in air or under water with a velocity of about 1 lineal metre in four minutes, and detonate in air or under water with a velocity of about 5 k.m. if exploded with a gramme of fulminate.

The following trials were also made to determine the stability of the fuzes and their safety when used:—

(*a*). Some pieces of the fuzes were kept for two consecutive years, without any protection and exposed to the atmosphere, under the roof of a manufactory near Turin, and some of them burnt and exploded with the same regularity as before they were placed under the roof. It was however found advantageous to close one of the ends with gummed tubes, securely attached to the fuzes.

(*b*). Pieces of the fuze enclosed in wooden boxes, and in boxes bound with sheet iron, were next fired at with ball cartridge from a distance of 10 metres. All the pieces of the fuzes, enclosed in wooden boxes which were struck by the bullets, burnt, but only a portion of those enclosed in the iron boxes burnt, the rest falling to the ground without burning, but with a partial detonation at the point actually struck by the bullet. Similar trials, which gave the same results, were made with pieces of fuzes kept under a roof for nine months.

(*c*). Several pieces of fuze were placed in sea water with a temperature of between 55° and 60°; they were kept at this temperature for 12 consecutive hours. There was then an interval of 12 hours, after which they were left for another 12 hours.

It was found afterwards that the fuzes burnt regularly, although slightly quicker in the air, and that they detonated regularly. These last trials were repeated with four or five pieces of fuze each day for 20 consecutive days, similar results being always obtained.

(*d*). Some pieces of fuze were kept for 40 days under the snow, whilst others were exposed for 24 hours to a temperature of 20° below zero. They burnt and exploded regularly.

(*e*). Pieces were immersed in water for 50 days, with their extremities protected by gummed tubes, and burnt and exploded regularly when taken from the water.

From these trials it is fair to assume that the detonating fuzes of ballistite and powder in grains have the properties of stability and of great safety in handling.

To ensure the proper explosion of the fuzes, a capsule containing at least 1 gramme of fulminate of mercury must be used for detonation, as experiments proved that detonation is not always certain when capsules containing less than 1 gramme were used. It is sometimes necessary to join up pieces of fuze, and for this copper tubes of 5 or 6 c.m. may be

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used; the proper contact of the pieces within the tubes must be very carefully attended to.

Under the title of "Tactical Studies of the Three Arms," Capt. Luigi Giannitrapani, the well-known author on military subjects, has collected and published a complete summary of his views.

Chapter VIII. deals with the future employment of field fortification. The lessons learnt from the Boer and Russo-Japanese Wars have certainly convinced us that in consequence of the extraordinary power of modern guns and rifles, field fortification has become a weapon of defence constantly at the disposal of the soldier, and is now so completely allied to tactics that it is impossible to advance a step, either in attack or defence, without taking advantage of cover.

We intend to speak of that branch of field fortification which we are accustomed to call "improvised." The experience of war teaches that we have to construct trenches, as much to conceal the combatants as to provide for them the best conditions for protection. Also that these trenches should have the *least elevation*, the *least width*, and the *least exposure*.

The employment of improvised fortifications should not be considered as an exclusive aid to tactical defence only, but also as a powerful auxiliary of offence.

The more important questions relating to the employment of field fortification in the wars of the future, may be considered under the following heads:—(1), The distribution of sappers' tools to the infantry; (2), determination of the time that the infantry soldier should work; (3), the manner in which the detachments of engineers should be employed; (4), the most convenient works that should be executed for the strengthening of a position, either for offence or defence; (5), utilization of localities and of woods as an auxiliary to field fortification; (6), organization of entrenchments for artillery.

(1). *Distribution of Sappers' Tools to the Infantry.*—It is absolutely necessary to lighten, as far as possible, the weight to be carried by the infantry soldier, and the portable tool should be considered as necessary to the soldier as his rifle.

According to the "Instructions in the Work of Sappers for the Infantry" in war time, the tools (93 in all) are distributed among the several squads in the manner that the commanding officer considers most convenient. It is certain that there should be one tool for each soldier, and, as the result of their recent experience during the war, this is being provided for in the Japanese Army.

It has always been impossible to gauge the sequence of events in a battle, and to-day this difficulty is greater than it was formerly. Consequently, if the tools are distributed before the commencement of the action, the very tools that are actually required may not have been issued, whereas, if one waits for the moment at which they are wanted, precious time may be lost, besides confusion being caused during the battle itself.

The system adopted in the Austrian Army is to distribute the tools required to the front ranks of each company.

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(2). *Allotment of the Time for the Soldier's Work.*—According to our regulations for "the instruction in the work of sappers for the infantry" mentioned above, it is laid down that, for the construction of trenches with light tools, the men should be arranged in one rank at 5-c.m. intervals along the line selected by the officer, and that they should not be employed continuously for more than half an hour—a sufficient time to complete the trench for a kneeling man. The question which may well be asked however is whether such conditions are practicable in view of the physical qualities of the soldier and the principles of modern tactics. The soldiers arranged for the work and almost elbowing one another, work with difficulty even with short tools. They then perform less work than they would do if they were able to work more freely and choose a more convenient position. It is clear that for freedom for work a certain interval between man and man is required, and that of 5 c.m. is quite insufficient.

The duration of the work fixed for half an hour is considered excessive, because the spade—like all tools of that kind—is fatiguing to the soldier from the bent position which he has to assume when removing the earth. In addition to this, he has to excavate the trench under the danger of being hit by the enemy's fire, and has therefore to work with the greatest energy and alacrity.

From experiments made in Italy and abroad, and in the opinion of those who have taken part in the war in the Far East, spells of from 10 to 15 minutes' work are ample, with rests of about the same length of time in between.

(3). *Employment of Detachments of Engineers.*—Engineer troops—whether actually in contact with the enemy or not—should prepare for defence works of support of general importance. They should also be employed on demolitions, and lay out and trace works of communication, etc., while the completion of the works themselves should be executed, as opportunity occurs, by the same troops who occupy the various points of the same position.

(4). *On the Execution of Works for the Rapid Strengthening of a Position.*—These may be grouped as follows:—(1), Trenches and redoubts; (2), works thrown up rapidly for cover; (3), masking the position.

In dealing with the first of these the author points out that the modern trench should be of the simplest kind, and only of such a form as the soldier can easily understand and can execute with facility. The Japanese—especially in defence—used two types of trenches; the first, which was for one or two men lying on the ground, consisted of a simple isolated heap of earth, about 30 c.m. in height, sufficient to protect the head and shoulders. The second type served for the firing line on foot, and consisted of a simple trench about 80 c.m. in depth and 50 in width, and with a parapet of 40 c.m.

The small trenches for one or two men should serve for the isolated groups in front of the firing line. If the soil be hard and stony, bags filled with earth or sand must be used to form a first protection immediately in front, so as to impede the fragments of stone caused by the projectiles striking rocks, etc., in the foreground.

EDWARD T. THACKERAY.

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RECENT PUBLICATIONS OF MILITARY INTEREST.

OCTOBER, 1909.

(*Published Quarterly*).

THE following extracts from the list compiled by the General Staff War Office, are published in the *R.E. Journal* by permission of the Army Council.

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PART II.

SECTION I.

AERIAL NAVIGATION.

AVIATION (L'aviation). By *Capt. F. Ferber, French Army. 250 pp., with numerous diagrams. 8vo. Paris, 1908. Berger-Levrault. 4s.

Capt. Ferber has done, perhaps, more than anyone else in France to develop the art and science of aviation, and his opinions deserve careful study. (In France the term "aviation" is confined to the flight of machines heavier than air).

The book deals exclusively with aeroplanes (four pages only being devoted to remarks on ornithopters and helicopters), and is divided into two parts, the first part being historical and descriptive, and the last part mathematical. This historical and descriptive part commences with a lucid summary of the underlying principles of the flight and stability of aeroplanes. This occupies fifteen pages. Then follow one hundred and seventeen pages covering the history of the subject from Cayley (1809) to the present day. This portion is very fully illustrated, and includes short accounts of the gliding experiments of Lilienthal, Pilcher, Ferber, and the Wrights.

The more modern historical portion is confined to French experiments. A short *résumé* is given of the principal points considered to be established by the author's own experiments, and finally about twenty-one pages are devoted to some interesting anticipations, some of which have already been realized.

The four pages devoted to the use of flying machines in war should be read, being as they are the views of an artillery officer, who has made a thorough theoretical and practical study of aeroplanes.

There is a short note on some details of construction, followed by the mathematical portion, which occupies eighty-two pages. Conclusions based on mathematical argument cannot, in most cases, be accepted as final, owing to the uncertainty that exists as to several of the premises, but the author's mathematical analysis is worth studying. The theory of the screw propeller is well treated.

* The author, a most brilliant officer, has since paid for his devotion to aviation with his life, having met with a fatal accident whilst making a flight with his aeroplane at Boulogne.

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THE AEROPLANE OF THE BROTHERS WRIGHT (L'aéroplane des Frères Wright). 30 pp., with diagrams. 8vo. Paris, 1908. Berger-Levrault. 1od.

This book contains :—

(1). A report presented by the Brothers Wright to the Aero Club of America in 1906, giving details of their progress to date.

(2). The conditions of contract for the supply of an aeroplane, issued by the Army Board of Ordnance and Fortifications of the U.S.A. in 1908.

(3). Particulars of trials carried out by Orville Wright at Fort Meyer in September, 1908, up to the time of the accident, resulting in the death of Lieut. Selfridge.

(4). Particulars of the French patent specification deposited by the Wright Brothers in March, 1904, together with drawings and some explanatory information.

(5). Description of the machine with which Wilbur Wright made his first experiments in France in 1908.

BOOKS OF REFERENCE.

THE RISE AND PROGRESS OF THE BRITISH EXPLOSIVES INDUSTRY. Published by the Explosives Section of the VIIth International Congress of Applied Chemistry, and edited by E. A. Brayley Hodgetts. 418 pp., with numerous illustrations. 4to. London, 1909. Whittaker, 15s.

This elaborate compilation contains a complete history of the manufacture of explosives in this country, and traces the development and uses of various kinds of explosives, from their discovery up to the present day.

The subject is dealt with in two parts, namely, "Historical" and "Descriptive." The latter contains a description of "Existing Government establishments" and of "Private establishments," and gives an account of their origin and subsequent history. The "Historical Part" is of greater interest from a military point of view, and contains special articles by recognized authorities on the various subjects dealt with.

As a book of reference this work may be considered of great interest.

THE ARMY ANNUAL. Edited by Major F. S. Baden-Powell. 447 pp., 4to. London, 1909. The Army Press. 7s. 6d.

The contents of this year's edition differ from those of previous years in so far as information contained in the latter, which has become out of date, has, to a great extent, been omitted.

Information with regard to the health of the Army and the Indian Military Supply Department has been added, and an account of the progress of the Territorial Force and aerial navigation is given. Lists of "Public Inquiries into Army Matters since 1800" and "Interesting Questions and Answers in Parliament" are also for the first time included in this volume, which maintains the same general features as the last edition.

CAVALRY.

THE RÔLE OF CAVALRY IN RECONNAISSANCE AND SECURITY DUTIES (Rôle de la Cavalerie dans le Service d'Exploration, de Sureté, et de Couverture). By Capt. Janet. 36 pp., with 6 maps. 8vo. Paris, 1909. Chapelot. 1s. 2d.

This short pamphlet endeavours to prove that, as a general rule, too much is expected of the cavalry as far as concerns obtaining information, and affording a commander a clear insight into the actual position of affairs in the theatre of war. The writer claims that the old theory of superiority in mounted troops ensuring the receipt of full and accurate intelligence is exploded, and that under modern conditions it is impossible for

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the cavalry, however great its superiority in numbers and handling, to obtain information on which a commander can place implicit reliance. He asserts that, though secret agents and kindred methods of collecting intelligence can be utilized with advantage, no true reconnaissance can be carried out unless a force of all arms is employed. In support of his contention he quotes specific instances from the war of 1870, tending to show that the mounted troops, sometimes under the most advantageous conditions, failed completely to "clear up the situation," owing to the lack of the support of the other arms.

FORTIFICATION AND MILITARY ENGINEERING.

IMPROVISED BRIDGES (Ponts Improvisés). By G. Espitallier and F. Durand. 284 pp., with 99 illustrations. 8vo. Paris, 1909. Doin. 4s.

This volume is intended essentially as a guide to practical work in the field, and, as such, forms a most complete and concise book of reference. Military bridges are classed under the usual categories of floating, pier, and suspension, and various types of each are considered in minute detail, and their method of construction clearly shown by means of excellent illustrations. Calculations are given for estimating the carrying capacity of each type, and, though complicated details are avoided, the data are sufficiently concise for all practical purposes.

Special reference is made to the system invented by Lieut. Tarron, which was tested in 1904, when a flood carried away the bridges in the village of Bozel. On this occasion a semi-permanent bridge on his system, with a span of 25 yards, was constructed in 72 hours. It is claimed that bridges of this type, without intermediary supports, can be used for a span of 50 yards, and though their camber appears somewhat excessive, their utility is undoubted in the case of mountain gorges, when it is impossible to employ either floating or pier bridges, and when material for a suspension bridge is not forthcoming. A short chapter is devoted to light foot and other quickly constructed bridges, which are especially suitable in the case of advanced guards and other detached bodies of troops, whose transport must be reduced to the lowest possible scale.

Our own manuals contain practically the same information regarding flying bridges as is given in the present volume, but there is much which will be new to the non-specialist officer in the paragraphs dealing with cordage and other make-shift suspension bridges.

Perhaps the most interesting chapter is that which deals with the bridging equipment of the French Army and that of the armies of other Powers; it concludes with a table giving the number of pontoons or boats taken into the field, the method of transport, length of bridge which can be constructed, etc., in the case of each of the various armies. The last chapter touches on the question of the preservation, destruction, and restoration of the different bridges commonly constructed in the field.

PERMANENT FORTIFICATION (Die Beständige Befestigung). By Ritter von Brunner (Major, Austro-Hungarian Engineer Staff). 149 pp., 1 plan, with numerous plates and figures. 4to. Vienna, 1909. Seidel. 5s.

The author of this well-known work, now in its seventh edition, states that he has arranged his subject in an altogether different manner to that adopted in the previous editions; for example, he has endeavoured to separate the technical details from the tactical and strategical portion of the subject. In addition, there is a great deal of new material, notably the plan of a modern girdle of forts, and what perhaps is of more particular interest to the British Army, a more detailed handling of coast defence and local or "blocking" works ("Sperrwerke") in hilly country.

The chapters are five in number:—

I.—Introduction.

II.—Use of permanent fortifications (with examples from Central Europe).

III.—Land defences—

A. The "girdle" fortress.

B. "Blocking" works.

C. Special forms of land defences.

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IV.—Coast defences—
A. Remarks on warships.
B. Effect of naval and fortress guns against ships.
C. General arrangement of coast defences.
D. Details concerning coast defences.
V.—Improvised or supplementary works.

HISTORICAL.

THE NATIONAL WAR OF 1812 (La Guerre Nationale de 1812). Published by the Russian General Staff. Translated by Capt. E. Cazalas, Historical Section of the French General Staff. Vol. III., 443 pp.; Vol. IV., 481 pp.; Vol. V., 448 pp. Each volume has an index. 8vo. Paris. Lavauzelle. 8s. 4d. per volume.

The historical value of these volumes is very great, since they contain the whole of the enormous correspondence of the Russian War Minister, General Barclay de Tolly, from May to October, 1811.

In Volume III. and Volume V. an interesting light is thrown on the intelligence and secret service systems of the Russian Army. In Volume IV. all other matter is dwarfed by the historic despatch of General Barclay de Tolly to the Czar, which was the genesis of the strategy that destroyed the "Grande Armée." The Russian War Minister, after examining the causes that had contributed to the success of the French, lays bare the weak points in their organization and administrative methods. He points out that Napoleon's new method of war must in its turn be met by a still newer method, that of taking famine as an ally, avoiding all decisive battles, and operating incessantly against the flanks and rear of the enemy. In no country could these methods be applied more successfully than in Russia, with her wide spaces and her rigorous climate, while the hordes of irregular horsemen at the disposal of the Czar formed an admirable instrument for putting them into execution. The lines of advance open to Napoleon are then reviewed, with suggestions as to how each invasion should be met.

The want of a map forms a serious handicap to the reader.

THE QUESTION OF FORTRESSES IN THE DEFENCE OF STATES. (Grundlagen und Aufgaben der Reichsbefestigung). By Colonel J. Schön, of the Austro-Hungarian Infantry. 112 pp., and 3 maps. 8vo. Vienna, 1909. Seidel. 2s. 9d.

This book is a reprint of articles which appeared in the third and fourth parts of "Mitteilungen über Gegenstände des Artillerie-und Geniewesens" of the current year. The title is somewhat of a misnomer, as the discussion is mainly confined to the influence exercised by the fortresses in the two campaigns of 1796-7 and 1866; the first twenty pages however contain remarks of more general application.

Whilst enumerating cases in which the possession of fortresses has exercised a harmful effect upon the general operations of a campaign, the author by no means adheres to the views expressed in the work, "Influence of Fortresses in Military Operations" (by P. Rath), reviewed in the April number of this publication; on the contrary, he shows that the possession by the Austrians of the various fortresses in the two campaigns specified contained much that was or might have been advantageous.

GERMAN OFFICIAL ACCOUNT OF THE RUSSO-JAPANESE WAR. Liao-yang. Authorized translation by Karl von Donat. 221 pp., with 10 appendices and 10 maps. 8vo. London, 1909. Hugh Rees. 10s. 6d.

This volume is a continuation of the series of which parts have appeared from time to time, the last instalment, "Wa-fan-gou," having brought the history of the war down to

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the eve of the Battle of Liao-yang, after the junction of the Japanese 2nd, 4th, and 1st Armies. The present portion, after a brief *résumé* of the situation, takes up the story on the morning of the 29th August, 1904.

The work suffers from the defects of the previous instalments, in that the names of places are transliterated after the German system. It is often very difficult to find villages on the maps, and since there is a large amount of detail in the account, it is at times fatiguing to a British reader. But the progress of the fight can be traced from the admirably clear way in which the forces are shown on the maps, and the last two chapters, describing the Russian retreat, and commenting on the conduct of the battle, are models of lucidity.

Attention is drawn throughout to the nervousness which General Kuropatkin exhibited as to his line of retreat, and General Umezawa's small detached force, operating in the mountains miles to the eastward, is shown as exercising an undoubted effect upon the battle, owing to the exaggerated reports to which its presence gave rise. The alternative courses open to the rival commanders are discussed in the last chapter. General Kuroki's action in passing half his army (the 1st) to the right bank of the Tai-tzu Ho early in the action is adversely criticized, but is condoned since it arose from an erroneous belief that the Russians had commenced their retreat. On the other hand, his vigorous action when he discovered his error is most favourable contrasted with that of his opponent. The situation is summed up in the words: "The will to conquer, conquered."

The appendices contain details as to the strength of the opponents and their disposition at various dates.

GENERAL WOLFE. By E. Salmon. 242 pp., with index. 8vo. London, 1909. Pitman. 3s. 6d.

This admirable study of the life and achievements of General Wolfe is one of the series of "Makers of National History."

In the first half of the book Mr. Salmon briefly draws a clear and sympathetic portrait of the subject of the memoir. He gives an excellent idea of his character and of the manner in which he came to the front notwithstanding lack of private means and of influential connections.

The second half of the book contains a detailed account of the Quebec expedition up to the death of General Wolfe, at the very moment when success was assured. The plan of the St. Lawrence River and defences of Quebec render the description of the operations easy to follow.

Mr. Salmon makes use of the latest ascertained facts about the expedition, and shows that the success which attended it was due to General Wolfe's personality and plan for the final assault, and not to the action of his subordinates.

FIELD MARSHAL SIR NEVILLE CHAMBERLAIN, G.C.B. By G. W. Forrest. 504 pp., with index. 8vo. London, 1909. Blackwood. 18s.

The record of this distinguished soldier's services in India is so closely bound up with the history of the country itself that, to appreciate the former thoroughly, it is essential to have a clear outline of the latter, and this the writer of Sir Neville Chamberlain's biography has given us in his admirable description of the stirring events with which this period of British rule in India was replete.

The subject of this biography landed, as a cadet of eighteen years of age, at Madras in 1837, and did not sever his connection with India until 1881, after five years in command of the Madras Army.

During this period he was actively employed in nearly every campaign which took place in that Empire, and it can be said, without exaggeration, that he distinguished himself in every one of these, both by his personal dash and bravery and by the soundness of his judgment, as shown by the numerous letters now published.

Although a stern disciplinarian, he was full of human sympathy, and, notwithstanding the difficult positions in which he was frequently placed, he managed to gain the goodwill and hearty co-operation of all with whom he came in contact, by sheer strength of character and force of example.

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The chapters dealing with the Indian Mutiny are among the most interesting in the book, and it is only by means of these private family letters that we are enabled to appreciate to the full the part which this daring and modest officer bore in the Siege of Delhi, even when incapacitated through a severe wound from leading the troops in person.

To the sportsman the description of Chamberlain's expeditions in South Africa in search of lion will especially appeal, and the account of the hairbreadth escapes he had show clearly that his utter disregard for personal danger was not confined to the field of battle.

Mr. Forrest, in his concluding paragraph, says of Sir Neville Chamberlain : "His own letters and diaries through the long series of his years show how great personal valour was combined with a true spirit of kindliness, and humanity and skill in war were intertwined with a love of culture and a serious interest in great questions." The best word said of him was by another Warden of the Marches : "Chamberlain was the soul of chivalry." This opinion will be endorsed by all who read this interesting narrative.

NAVAL.

THE NAVAL ANNUAL, 1909. By T. A. Brassey. 426 pp., with numerous plates and diagrams and index. 8vo. London, 1909. Griffin. 10s. 6d.

In view of the recent course of events and the interest which has been evoked in the progress of the navies of the world, this year's *Naval Annual*, which is as usual divided into four parts, is of especial interest.

Part I. commences with a review of the year's work in British and foreign navies, with their comparative strength in tabular form. It also contains chapters on dockyard administration, alternative systems of propelling machinery, naval volunteers, the naval expansion of gunnery, and manœuvres carried out during the year.

In Part II., which contains alphabetical lists of British and foreign ships with plans, the leading particulars of ships are, for the first time, given on the plates.

Part III. gives armour and ordnance tables, and reviews, as far as is possible, the progress made in production and development, and the general trend of opinion as regards advance in this section.

Part IV. contains the First Lord's statement, the Navy Estimates at home and abroad, the programme of shipbuilding, and a return of gunlayers' tests and battle practice. Lord Brassey contributes a paper on recent naval construction and a note on the Forth and Clyde Ship Canal. A letter on national defence, written by Mr. Frederic Harrison to *The Times*, in March, 1909, is also included. The other contributors are Mr. J. Leyland, Mr. A. Richardson, and the Marquess of Graham.

As a book of reference on naval matters this volume maintains the high standard of previous years.

FIGHTING SHIPS. By F. T. Jane. 491 pp., with numerous plans and illustrations. Fol. London, 1909. Sampson Low. 21s.

In this year's issue of *Fighting Ships* special attention has been paid in Part I. to the German fleet, and the present appearance of many of its ships is shown by means of photographs. As far as possible particulars of the new German warships are given, and they vary considerably from those hitherto published. The editor, whilst admitting that the exact correctness of these cannot be guaranteed, considers that in the main they will be found to be approximately accurate.

Every type of man-of-war to be found in the world's fleets is represented, with particulars of its construction, armament, and speed, and photographs of auxiliaries take the place of the representations of fast liners in former issues. Part I. also contains plans of destroyers and torpedo boats, and generally deals with these craft in greater detail than formerly. The illustrations throughout this part of the book, which are very numerous, are extremely clear and interesting.

Part II. contains a valuable article on "Protection of Battleships against Submarine Attack," by Professor W. Hoogaard, and Mr. C. de G. Sells again contributes a paper on "The Progress of Warship Engineering." A silhouette index of merchant ships concludes this useful book of reference.

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ORGANIZATION AND ADMINISTRATION.

SUPPLY SERVICES IN THE FIELD (Alimentation en Campagne). Official. 76 pp. 8vo. Paris, 1909. Charles Lavauzelle. 6d.

This publication replaces that issued in June, 1900.

After giving a general summary of the respective responsibilities of the higher commanders and of officers of the supply corps, it deals with the question of supply under the two broad headings of "Organization" and "Work in the Field." Special orders and instructions for general officers commanding divisions and larger units follow, whilst at the end of the volume are appendices giving the scale of rations, forage, and fuel under varying conditions.

As regards arrangement, the new volume differs but little from its predecessor of nine years ago, but the trend of modern ideas has necessitated the introduction of material alterations under the old headings, and the embodiment of fresh instructions to meet altered conditions of organization. As regards the "general summary of responsibilities," the respective duties of commanders and of supply officers are far more clearly defined than formerly, but the regulations, though emphasizing the importance of commanders and their supply officers being in close touch, empower the latter to act largely on their own initiative, and authorize them to depart, if needs be, from the instructions issued by the former.

Under the heading of "Organization" the chief innovation is the introduction of fixed supply units for an army, in addition to, but apart from, those belonging to army corps. These are: An administrative convoy, composed of two sections for each army corps; an army bakery, consisting of one field bakery per army corps; a cattle park, and various auxiliary convoys. The organization of supply units for army corps and divisions is practically the same as formerly. The rations and forage now to be carried for all arms (except cavalry) are:—

	Rations. Days.	Oats. Days.
(1). Reserve	2	1
(2). Regimental wagons	2	2
(3). Army corps administrative park	2	2
(4). Army administrative park	2	2
Total	8	7

In addition to the eight days' meat ration included in the above there will be four days' meat supply on the hoof.

The old regulations provided for rations of two descriptions only, viz., the increased scale ration and the normal ration. The new regulations include a third, namely, the reserve ration, which is not to be consumed without special orders. This reserve ration comprises 10½ ozs. of "galetta" (special bread biscuit), 10½ ozs. of preserved meat, 3 ozs. of sugar, 1¼ ozs. of coffee in tablet form, 1¾ ozs. of soup, and ⅜ dram of brandy. These are issued to the troops prior to their departure from the place of mobilization, and are carried partly on the man and partly in the first line transport.

In the cavalry the following reserve rations are carried:—

"Galetta"	1 day
Sugar and coffee	3 days
Meat and soup	1 day
Brandy	1 ,,
Oats	4½ lbs.

The 4½ lbs. of oats may be consumed as soon as camp is reached, but in this case they must be replaced from the daily issue. Mention is made of the new mobile field kitchens, which may be issued to certain army corps at the rate of one per unit, and instructions as to their use are given.

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Under the second main heading of "Work in the Field" are included additional instructions for officers entrusted with supply duties, and for the employment and re-victualling of the new army administrative convoy.

The special instructions to divisional and higher commanders are amplified, and the points with regard to which supply officers should act in consultation with general officers commanding are more clearly defined.

Appendix I. gives as formerly the number of rations allowed for all ranks, but the scale of substitutes has been much increased.

Appendix II. deals with the forage. The scale of issue remains unchanged, but, apparently through an oversight, the scale of substitutes has been omitted.

Appendix III. gives the fuel ration. The issue of wood has been diminished, that of coal has been increased.

Appendix IV. gives the tobacco issue.

Several appendices which appeared in the old regulations, notably that dealing with the rations to be issued prior to entraining, etc., have not been reproduced in the new volume.

THE COLONIES AND IMPERIAL DEFENCE. By P. A. Silburn, D.S.O., M.L.A., Natal, late Major, Natal Permanent Forces. 360 pp. 8vo. London, 1909. Longmans, Green. 6s.

The author has carefully studied the question of Imperial defence, and his views as a late member of the Natal Permanent Forces and as a practical politician are entitled to consideration. Roughly speaking, Mr. Silburn is against small colonial and self-owned navies, and also against the existing system of monetary grants. The former, he considers, are likely to lead to secession, while the latter, unless the amount granted (and that, in his opinion, is quite impossible) is surplus to the Colonial Defence Vote, means the weakening of the Empire's defences. Mr. Silburn believes that the withdrawal of such grants will be more than compensated for by the strengthening of colonial militias and by adequate defences for colonial harbours. He is in favour of a proportion of the colonial militias being available for service in other parts of the Empire, and estimates that more than 115,000 men for this purpose could be raised in the different large self-governing colonies.

Finally the author urges the desirability of establishing an Imperial Council of Defence consisting of:—

3	members	to represent	the Navy;
2	,,	,,	,, Home-Serving Army;
2	,,	,,	,, Indian Army;
1	member	,,	Australia;
1	,,	,,	Canada;
1	,,	,,	South Africa; and
1	,,	,,	New Zealand.

To follow the arguments in favour of the various conclusions arrived at is impossible in the limited space available, but it may be noted that Mr. Silburn apparently has a special predilection for coast defences, which he occasionally describes as "commanding" certain seas, which he believes would go far towards rendering secure the Imperial trade routes. Many of these defended ports might, he thinks, be cheaply garrisoned by training the natives of Africa as garrison gunners.

UNIVERSAL SERVICE. By Colonel Sir C. M. Watson. 31 pp. 8vo. London, 1909. Rees. 6d.

This little pamphlet is a *résumé* of some of the arguments for and against the system of voluntary service, conscription, and universal service, with special reference to our requirements. The principal advantages and disadvantages of each system are first briefly discussed and summarized. Universal service as applied in Germany and Switzerland is then shortly described and its application to Great Britain considered.

The author considers that the advantages accruing from universal service, both to the army and to the nation, far outweigh the few minor inconveniences that might be experienced by individuals, and puts his case forward in a very succinct manner.

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POLITICAL.

AUSTRIA-HUNGARY. By Geoffrey Drage. 846 pp., with numerous maps and statistical tables. 8vo. London, 1909. Murray. 21s.

This book is the result of data collected by the author during a period extending over many years. It is not produced merely as a result of the present position of affairs in the Near East, but to meet a permanent demand for a clear authority on the numberless economic and political problems peculiar to Austria-Hungary.

The political, commercial, financial, and industrial aspects in Austria are first dealt with, followed by a similar presentation of these subjects in respect to Hungary. Affairs "common" to both portions of the Monarchy are then discussed, followed by chapters on the racial question, the annexed provinces, and finally the Balkan position.

There are probably not many individuals in this country, military or otherwise, who have any very clear knowledge as to the meaning or possible consequences of the statements, which appear daily in the newspapers, on the varied questions of the racial problem in Austria-Hungary, the parliamentary crisis in Hungary, the independence party, the Pan-Slavist agitation, the agrarian and bank movements, and so on.

The present book will give to the reader an easily understandable representation of all these exceedingly complicated points.

FROM THE TREATY OF FRANKFORT TO THE ALGECIRAS CONFERENCE (De la paix de Francfort à la conférence d'Algésiras). By André Mévil. 328 pp. 8vo. Paris, 1909. Plon-Nourrit. 3s.

M. Mévil's work is almost exclusively a denunciation of the foreign policy pursued by Germany since the war of 1870, a policy which, in the writer's opinion, has always had for its one aim and object the isolation and subsequent annihilation of France. M. Mévil seeks to show how Bismarck, as the originator of the anti-French policy, directed all his efforts towards ensuring that France should find herself standing alone and unaided by any other Power did she enter on a fresh conflict with Germany, and also how the Chancellor's successors have followed in his footsteps. The means used to further this policy meet with the writer's severest condemnation.

The Franco-Russian Alliance was a set-back to Germany, and she has tried ever since to find means to weaken Russia's power; it was, indeed, mainly German influence which induced Russia to adopt an attitude which left Japan no alternative but a declaration of war.

The alliance of France with Russia is not however regarded in Germany as militating against the isolation of France to nearly the same extent as does the Anglo-French *entente*. England is, in reality, the only nation seriously feared in Berlin, because against her alone of all the nations Germany is powerless to take aggressive action, and she alone can pit against Germany a real offensive force—namely, a predominating navy. The cementing of this *entente* more than compensates for the severe political defeat sustained by France at the hands of Germany at the Algeciras Conference, a defeat which should never have been experienced, seeing that Germany had no intention of and no object in declaring war at that time.

With England at her back France can afford to ignore German bluff and attempts at intimidation. A triple *entente* between England, France, and Russia forms a safeguard against German aggression, and were Italy to throw in her lot definitely with these three, the peace of Europe would be ensured.

Such are the opinions of M. Mévil, whose book serves at least to throw many side lights on the political history of Europe during the past 38 years.

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STRATEGICAL AND TACTICAL.

SOME REMARKS ON THE BATTLE OF REZONVILLE, 16TH AUGUST, 1870 (En marge de la bataille de Rezonville). By General Cherfils. 44 pp., with 4 maps. 8vo. Paris, 1908. Berger-Levrault. 1s. 11d.

This pamphlet contains some interesting notes on the Battle of Rezonville, especially in connection with the action of the cavalry. These are followed by an imaginary description of the lines on which the battle would be fought at the present time.

The most valuable part of the work is however the last chapter, in which the author deals with the moral aspect of the battle; he calls Rezonville the "bataille morale par excellence" of modern battles, and shows the great influence exercised by *moral* on the course of the fighting, which alone saved Alvensleben from a crushing reverse. Though he criticizes Alvensleben's action as rash, he admits that his conduct was that of a bold and determined leader, and says that he is really the man who, by his daring rashness, made the German Empire a reality.

The last three pages give a good description of the German conception of modern war, showing the enormous importance which should be attached to the moral qualities, to patriotism, sense of duty, and self-abnegation. General Cherfils agrees with the German view that an army "rotten with love of comfort and luxury, whose training and education are not imbued and thoroughly impregnated with the spirit of abnegation and self-sacrifice, is incapable of gaining victory and is ripe for defeat."

TACTICS OF TO-DAY. By Colonel C. E. Callwell, C.B. 162 pp. 8vo. London, 1909. Blackwood. 2s. 6d.

This is the second edition of this book, which was originally published in 1900. Some important alterations have been introduced as a result of experiences during the later stages of the South African War, and of lessons learnt from the Russo-Japanese War.

The object of the volume is to point out how existing conditions necessitate sweeping modifications in the rules and principles of conducting combats which have been accepted up to recently. Branches of tactics which are not greatly affected by the introduction of modern weapons are but cursorily touched on, and a complete picture of tactics is not attempted.

The author deals in successive chapters with the principles of attack and defence, the tactics of infantry, mounted troops and artillery, and defence works. His conclusion with regard to attack and defence is that the latter has gained to a much greater extent than the former by the improvement in modern arms, owing to the larger proportion of the defending side which can be kept in reserve for offensive purposes, without unduly weakening the force allotted to the passive defence of a position.

INVASION AND DEFENCE. By "Fabius." 200 pp. 8vo. London, 1909. Treherne. 2s.

In the preface it is stated that the object of this book is to draw attention—

(1). To the probability of German invasion in the immediate future in much greater force than is generally supposed.

(2). To the false position in which our fleet is placed by being tied to our shores.

(3). To the fatal mistake it would be to employ our Territorial troops, while still imperfectly trained, to oppose disciplined armies in the open field.

(4). To the necessity for constructing fortified and entrenched positions, as a means of gaining time for the organization of our reserves, the reception of reinforcements and the training of untrained troops, and for the purpose of protecting vital points of the kingdom, which are at present defenceless on the landward side.

(5). To the very great possibilities which might result from adopting at the outset this policy of defence.

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The author gives an outline of the naval and military situation, and of the present plan of defence, and then enlarges on his proposed alternative scheme, which he has worked out in some detail. He assumes that the position of Great Britain in the case of a really serious invasion would be exactly the same as that of the allied forces in Portugal during the Peninsular War, and bases his conclusions on the success which attended the defence of the lines of Torres Vedras. The imaginary siege of London is described, and about three months after the outbreak of hostilities, during what is called the third stage of the siege, the offensive is adopted and the invaders are defeated.

TRAINING AND EDUCATION.

STRATEGY OF THE FRANCO-GERMAN WAR. By Brevet Major W. D. Bird. 126 pp., with maps, sketches, and tables. 8vo. London, 1909. Rees. 6s.

The lectures on this subject, which the author delivered at the Indian Staff College, are here presented in book form. After shortly describing events leading up to the outbreak of hostilities, he deals fully with the operations up to and including the Battle of Sedan, from a strategical point of view.

The facts have been taken from the official accounts of the war, and have been so arranged that the campaign can be studied from either the French or German side. A number of sketches show clearly the "supposed" and "real" positions of the opposing armies at various dates between 26th July and 1st August, and these, together with discussions on alternative plans of operations at critical junctures, greatly facilitate a close study of the campaign.

The volume concludes with twelve "Problems suggested by the Operations," and the Appendices include tables showing the "Organization of the French and German Armies in 1820," and the daily dispositions of the forces engaged.

AN INTRODUCTION TO THE HISTORY OF TACTICS, 1740—1905. By Capt. A. F. Becke. 104 pp. 8vo. London, 1909. Rees. 3s. 6d.

This short study of the history of tactics is published with the object of assisting candidates for examination. It is not intended to be an exhaustive treaties on the development of tactics, but merely to furnish the foundations for a more extensive study of the subject.

The author deals generally with the evolution of tactics from the time of Frederick the Great up to the present day, and divides these two and a-half centuries into six periods.

The principal changes in each period are first generally described, and their effect is then briefly considered by individual arms, suitable battles being cited in illustration of the developments of the period.

In the Appendices, which comprise the last thirty pages of the book, Capt. A. Becke discusses more fully the employment of column and line between 1723 and 1815, and maintains that the column formation, as adopted by the French at this time, was only a formation of readiness and manœuvre, and not one for the decisive attack. He then deals in greater detail with the more important points in the tactics of the Russo-Japanese War, and in conclusion gives a series of questions, many of which are taken from papers that have been set at militia competitive examinations, but all of which do not appear to be fully answered in this volume.

THE PRACTICAL TRAINING AND EDUCATION OF A COMPANY (Die practishe Ausbildung und Schulung der Kompagnie). By Capt. Rucker, German Army. 142 pp. 8vo. Berlin, 1909. Mittler. 3s.

This is the first part of a work of which the second part (dealing with musketry and field training) is in course of preparation.

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In an introduction the author advocates that drill and instruction in field duties should proceed concurrently, since an undue preponderance of drill in the early stages gives false impressions to men. Conversely, a man who realizes the demands of a modern battle will appreciate the importance of strict drill.

The book contains two sections devoted respectively to drill and the combat. In dealing with the former the author warns against undue repetition with a view to correcting mistakes, and against undue prolixity in giving explanations. The less marching past is practised the better will it be carried out.

In the section on field duties the author, amongst other things, lays down the following :—

Tactical discussions are a good means of instructing N.C.O.'s. Instructions at field exercises should give every possible latitude to subordinate commanders, whilst clearly indicating the object in view. Full information should be given concerning neighbouring units whether real or imaginary. Great attention should be devoted to the wording of all orders.

All ranks must be trained to fill positions higher than those normally assigned to them. Men should constantly be trained to watch distant objects with a view to improving their sight. When practising firing exercises, living targets are preferable to points in a landscape. In order to simulate the noise of the battlefield, drums should be beaten and bugles blown immediately in rear of the unit. As an aid to judging distance the exact distances between various points on a drill ground should be known to the men. Volleys should not altogether be neglected. To inculcate economy in ammunition, all rounds with a company should be distributed amongst a small proportion of it, the rest noting the time taken to expend it. In extended order sections of a company should be directed independently by commanders instead of marching by a section on a flank—valuable training is thus afforded to leaders of smaller units.

Thorough reconnaissance is a necessary preliminary to all good leading. Every commander should, when approaching unknown ground, move well in front of his command. This "hasty reconnaissance" is characterized as most important. A few men should constantly be sent out to reconnoitre *during a fight.*

"Schemes" for field days need not end in "fights." In peace exercises account must be taken of the reconnoitring activity of an enemy who is not represented by troops.

At field exercises things should be allowed to take their course. Instructions can be gathered from any kind of situation. The handling of units at war strength is essential for all leaders.

Reinforcements should, if possible, adjust sights before joining a firing line, but men firing should be trained to call out the range to newly-arrived men or parties. Each man must know his fire-unit commander, but men's attention should not be distracted by too much "re-forming."

Commanders joining a firing line should not assume command until a situation has been thoroughly grasped. Engagements must not terminate with the capture of a position. Rallying and pursuit should be practised. In pursuing through a wood, much noise should be made, with a view to alarming a retreating enemy.

The work is full of valuable hints for infantry officers.

What to Apply in Tactical Problems. By Capt. A. F. Becke. 173 pp. 8vo. London, 1909. Paul, Trench, Trübner. 3s. 6d.

The object of this book is to help officers studying for promotion examinations and those who are called on to see and criticize simple tactical schemes, and for these purposes it should prove of assistance.

The author lays stress on the application of the general principles contained in the official regulations and deprecates a rigid adherence to the wording of those publications, even for examination purposes.

The instructions under each subhead are concise, well arranged, and appear up to date.

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THE ENTRANCE EXAMINATION PAPERS FOR THE STAFF COLLEGE FOR 1909 (Die Aufgaben der Aufnahmeprüfung 1909 für die Kriegsakademie). By Major Krafft. 62 pp., with 9 figures in the text. 8vo. Berlin, 1909. Mittler. 1s. 6d.

The papers are set on the following subjects:—Military history, minor tactics, applied tactics, arms and ammunition, fortification, reconnaissance, sketching, history, strategical geography, languages, and mathematics. Solutions to all questions are given.

TRAVEL AND TOPOGRAPHICAL.

GEOGRAPHICAL PHOTOGRAPHS FROM ASIATIC TURKEY (Geographische Charakterbilder aus der asiatischen Türkei). By Hugo Grothe. 10 pp., with 176 photographs and 3 coloured maps. 4to. Leipzig, 1909. Hiersemann. 15s.

In this book the author gives to the public the first result of his journey of 1906—1907 through Asia Minor, Mesopotamia, and Persia. A large selection of photographs, with the necessary explanations added, illustrate the districts traversed by him, which, in view of the projected Baghdad Railway, are of especial interest.

The photographs selected illustrate the nature of the country, of the population, and of the various forms of dwellings, and a series is devoted to subjects of historical interest both ancient and modern.

MISCELLANEOUS.

THE FRENCH OFFICER (L'officier français). By Jean d'Epée. 154 pp. 8vo. Paris, 1909. Lavauzelle. 1s. 8d.

This book deals with the provision of officers for the French Army, and it is interesting to note to how great an extent the reasons given by the author for the deficiency of suitable material are applicable to the present state of affairs in this country.

The author attributes the lack of candidates for the army to the increase of work, a demand for better education and greater aptitude than formerly, and the enhanced responsibility of the *rôle* of an officer as an educator of a great part of the nation, without a corresponding addition to pay. As a result, the old families of France furnish fewer candidates for the army, while business men, who realize that their sons will have to work hard, prefer that they should be adequately paid for doing so. Another factor which is pointed out is that, while the officers' pay has remained the same, the general standard of living has been raised, with the result that money does not go so far as it used.

"SHALL WE BE INVADED?" ("Serons-nous envahis?") By "un Belge." 62 pp. 8vo. Brussels, 1909. Dewit. 10d.

This little brochure contains a considerable amount of valuable information on the question of the invasion of Belgium. In the first part the author shows in a convincing manner that a country, even if its neutrality is guaranteed by the European Powers, is nevertheless insecure without means of defence of its own. In the second part the various schemes of army reform in Belgium are examined, and the author states with lucidity his solution of the problem.

STATISTICS OF ARMAMENTS, POPULATION AND COMMERCE OF THE GREAT POWERS DURING THE LAST THIRTY YEARS (Kriegswesen und Volkswirtschaft der Grossmächte während der letzten 30 Jahre). By W. Ahr. 16 pp., with 21 statistical graphics. 8vo. Berlin, 1909. Vossische Buchhandlung. 2s.

Herr W. Ahr is an assistant in the Imperial Statistical Department, and this little work is probably of greater value in consequence. The graphics of the growth of population of the Powers from 1800—1908, of the existing peace and war strengths of their armies, and the number of ships in their fleets are the most instructive.

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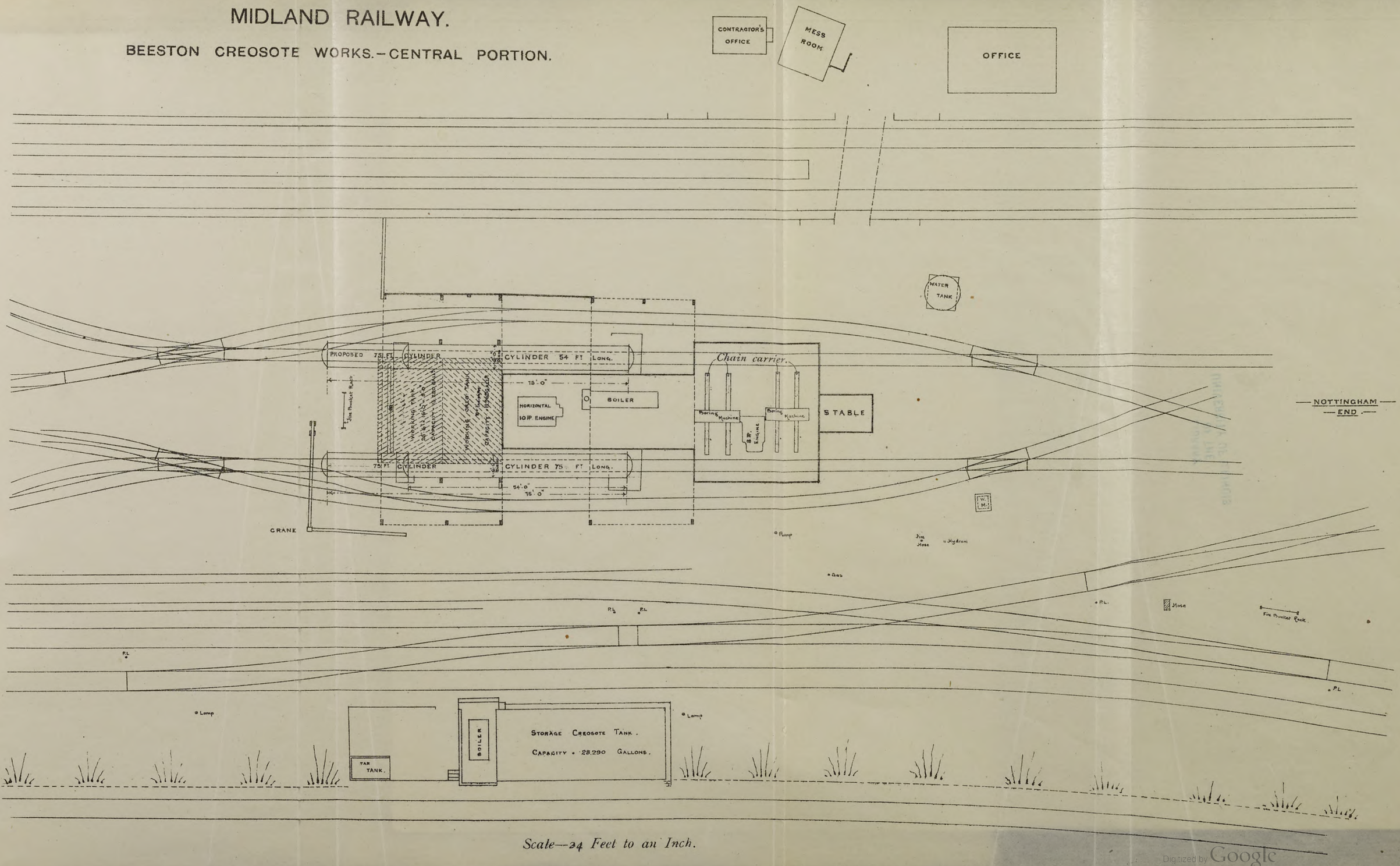
MIDLAND RAILWAY.

BEESTON CREOSOTE WORKS.—CENTRAL PORTION.



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IMPROVED INFANTRY FOOTBRIDGE.

3.—Bridge in use for passing pack transport across a river.

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IMPROVED INFANTRY FOOTBRIDGE.

1.—Bridge loaded on both roadways.

2.—Bridge loaded so as to give maximum torsion to the centre of the system.

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IMPROVED INFANTRY FOOTBRIDGE.

By Bt. Major R. L. McClintock, d.s.o., R.E.

An article entitled "Infantry Footbridge" was published in the July, 1909, number of the *R.E. Journal*, showing how a small number of casks, planks, and small spars could rapidly be converted into a footbridge for infantry.

This bridge however provided a single roadway in the centre of the piers only (*Fig.* 1), and a suggestion was made that it would be improved by having a track over each edge in place of the single track in the centre. This would allow traffic in both directions, and also admit of animals being more easily swum across by the aid of the bridge.

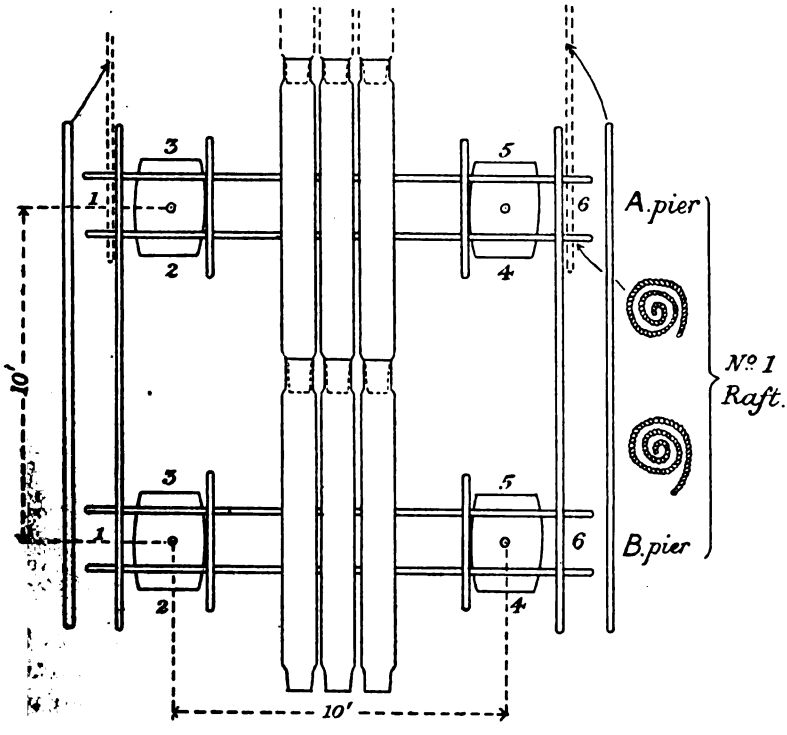

Fig. 1.—*One Complete Raft of Cask Footbridge (Original Pattern).*

An improved type (*Fig.* 2) was accordingly devised, and has answered the requirements perfectly. The only additional stores required are two chesses per 20′ run, while—by a readjustment of the framework of the piers—two 36′ lashings and four 4′ cross-pieces are actually saved in the same distance.

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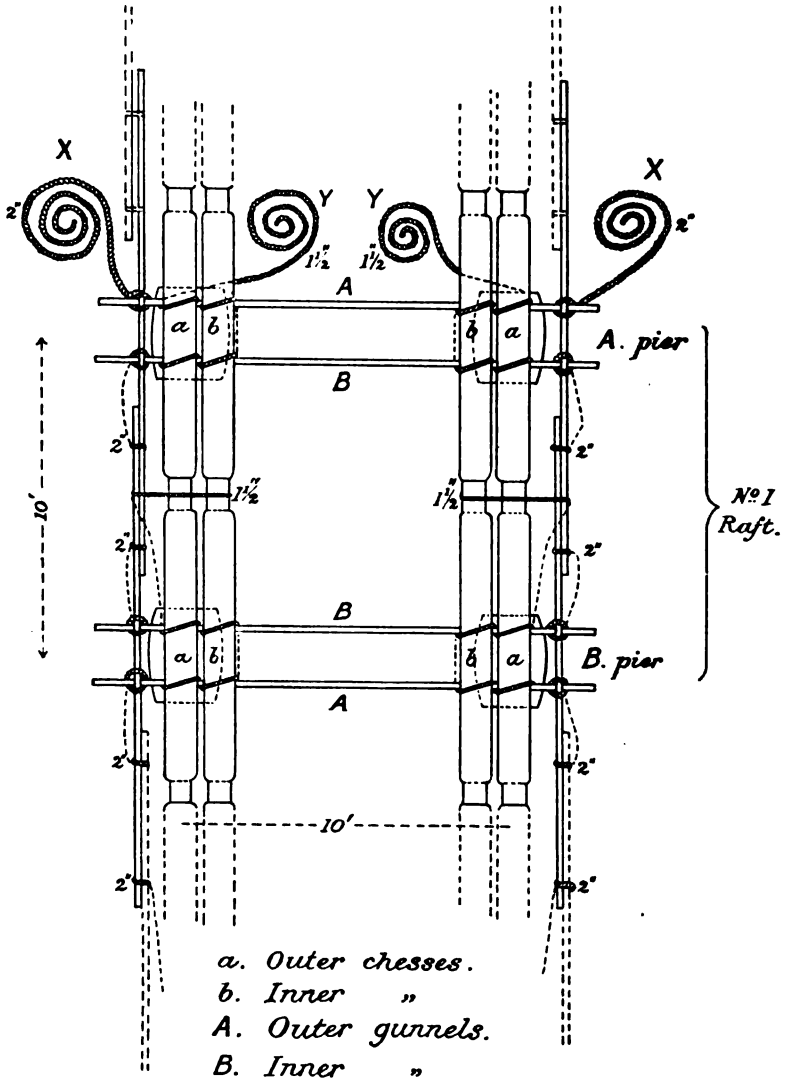

FIG. 2.—*Diagram of one Complete Raft of Cask Footbridge (Improved Pattern).*

As regards strength, Photo No. 1 shows the bridge loaded on both roadways at the same time, with men going in opposite directions. Photo 2 shows the bridge with the east half of the upstream roadway and the west half of the downstream roadway fully loaded at the same time, so as to give the maximum torsion to the centre of the system. No derangement of any sort took place, and the bridge proved to be astonishingly elastic. Photo No. 3 shows the bridge in use for passing pack transport across a river. The animals are swum across by the aid of the bridge, and the loads and saddlery are carried over it by hand.

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GENERAL PRINCIPLES OF ORGANIZATION AND EQUIPMENT, ROYAL ENGINEERS.

(*Continued*).

WIRELESS TELEGRAPH COMPANY, R.E.

Organization.—It has been decided that there is to be one wireless company stationed at Aldershot, belonging to the Cavalry Division.

This company is divided into 4 sections and 1 headquarter section, the wireless stations being allotted to sections as follows :—

No. 1 Section	... ...	2 wagon stations.
No. 2 Section	... ...	„ „
No. 3 Section	... ...	1 „ station.
	... ...	1 pack transport station.
No. 4 Section	... ...	2 „ „ stations.

The wagon stations have a range of about 80 miles overland to each other.

The pack transport stations, which are designed to be carried on pack when required, but are ordinarily carried in limbered G.S. wagons, have a range of about 7 or 8 miles to each other, and of about 10 miles to the wagon stations.

Establishment of a Wireless Telegraph Company.

In.	Officers.	N.C.O.'s & Men.	Horses.	Vehicles (Peace and War).	No.
Peace...	4	94	56*	Bicycles	4
				Wagons, limbered, wireless	6
				Wagons, light spring ...	6
War ...	5	129	114†	Wagons, limbered, G.S. ...	3
				Cart, water	1

* Excluding officers. † Including officers.

In addition, when mobilized, 1 A.S.C. driver for water cart, and 2 rank and file R.A.M.C., are attached.

The corporal (storeman) and the first reinforcement of 12 men mobilize with the unit, and are left at the base.

A detachment for the 80-mile station consists of 9 N.C.O.'s and men, who are carried on the wagons, with the exception of the senior

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N.C.O., who rides. They can, under normal circumstances, erect the station in half an hour.

A detachment for the pack transport station consists of 6 N.C.O.'s and men, who are all mounted. The station is erected in a quarter of an hour.

The trades required are telegraphists (office), telegraphists (line), fitters, who are trained to take charge of the petrol motors, and electricians.

Equipment.—Five of the wireless wagons carry, in the limber, all the instruments for transmission and reception, together with office stationery, etc. On the carriage are the petrol motor, alternator, mast, antenna, pickets, etc.

The sixth wireless wagon has no instruments in the limber, but is arranged to carry such of the accumulators of the pack transport stations as may need re-charging. The carriage of this vehicle is exactly similar to the other five, except that in place of an alternator a D.C. dynamo is provided for re-charging the accumulators.

Five of the light spring wagons carry petrol, oil, spare parts, men's blankets, forage, etc., for the 5 wagon stations, while the sixth is for the headquarters of the company, and carries such extra technical stores, as are not provided for each section.

The limbered G.S. wagons carry the pack transport stations, together with the blankets and one day's rations and forage of the detachments.

Each wireless station is thus entirely self-contained, and can move at any time independently of the rest of the company.

Duties.—The chief duties to be performed by the wireless company are :—

(1). Maintenance of communication between General Headquarters and the headquarters of the Cavalry Division.
(2). Maintenance of the internal communications of the Cavalry Division.

The 8 wireless stations of the company might then be employed somewhat as follows :—

Two 80-mile stations at Army Headquarters, of which one would be erected and at work, and the other ready to move at any moment.

Two 80-mile stations at Cavalry Division Headquarters, of which one would be erected and at work, and the other ready to move at any moment.

One 80-mile station at Cavalry Division Headquarters, for work with the 3 pack stations, which would be allocated thus :—

One pack transport station with headquarters of each of 3 Cavalry Brigades, the Cavalry Division Headquarters being presumably with the 4th Cavalry Brigade, which would consequently not require a separate wireless station.

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R.E. BALLOON UNIT.

Peace.—In peace time there is only one Balloon Unit of Royal Engineers, viz., the Balloon School, stationed at Aldershot.

The Peace Establishment consists of 7 officers (exclusive of a quartermaster), a warrant officer, 38 mounted ranks, 98 dismounted ranks, 4 riding and 32 draught horses and trains as 2 balloon companies. Of this establishment a certain proportion is detailed in peace as the nucleus of each of 3 balloon companies, which can be mobilized for war. The remainder (approximately one-third of the dismounted ranks with 3 officers) are not available for mobilization, as they will carry on instructional duties in the School.

The field training of the Balloon School starts with musketry at the beginning of March. Spring drills and fieldworks are carried through until the middle of April; then until June there is a recruits' course in ballooning and kiting. During June and July a company is generally sent to the Artillery Practice Camp at Lydd or Rhayader and Salisbury Plain, while one company is in camp at Aldershot. In August Divisional Manœuvres are attended, and in September the Army Manœuvres.

From the beginning of October to the middle of November two companies are employed with an officers' balloon course. During the remainder of the year, and whenever not employed in field training, the men are employed on public works, chiefly at their trades in the Balloon Factory.

The Balloon School is a school for training in ballooning. Young soldiers are sent there for two years for a complete course, and non-commissioned officers are appointed preferably from those who have already received instruction there. In peace time no portion of the Balloon School is sent abroad, except on special occasions. There is no foreign station where balloons are permanently kept up with the exception of India, where there is an experimental section.

War.—The War Establishment of a balloon company consists of 3 officers, 31 mounted ranks, 31 dismounted ranks, with 8 riding and 44 draught horses. Of the riding horses, a captain is provided with 2, and the subalterns have 1 each.

In addition, 1 A.S.C. driver for water cart, and 2 rank and file R.A.M.C., are attached.

The corporal (storeman) and the first reinforcement of 3 mounted and 3 dismounted men mobilize with the unit, and are left at the base.

All ranks except officers and R.A.M.C. are armed with the short rifle, and carry 50 rounds of ammunition per man in bandoliers. Great coats are carried *en banderole*. Men actually employed with a filled balloon in the field have their rifles and great coats carried on the wagons. 50 rounds of ammunition per dismounted man are also carried on the wagons.

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Vehicles.—1st Line Transport.

The vehicles consist of:—

1 *Bicycle.*

1 *Balloon and Kite Wagon,* on which are carried a balloon, cable, and all stores common to both balloons and kites. This wagon is drawn by 6 horses.

2 *G.S., R.E., Wagons,* one carrying equipment and one carrying baggage (each drawn by 4 horses).

6 *Wagons Reservoir Gas* (each drawn by 4 horses), each wagon containing nine 9′ gas tubes, the capacity of each tube being 500 cu. ft. The gas is compressed to 120 atmospheres.

Kites are carried at present on the gas wagons. A new balloon and equipment wagon is under design, which will enable the kites to be carried independently of the gas wagons.

All these wagons form the equipment accompanying the company in the field.

Vehicles.—2nd Line Transport.

1 water cart, drawn by 2 horses.

The unit can put in the air at the same time only one observation balloon or one flight of kites, which are used alternatively. Usually only one observer is sent up.

The chief articles of equipment and tools carried, besides ordinary stores and repair material common to all units, are:—

Signalling stores.
Drawing instruments.

And the following special technical stores:—

2 balloons of 11,500 cu. ft. capacity.
1 signalling balloon of 1,000 cu. ft. capacity, with a set of 4 small spherical balloons for making signals.
4 pairs of binoculars and spotting telescopes, each of the latter furnished with 10 and 20-power eyepieces.
Complete equipment for 2 balloons.
Set of photographic gear.
Captive steel wire rope, 4,000′ long.
A number of cotton ropes.
4 telephones.
2 telephone cables, each 4,000′ long.
1 complete set of kites and equipment.

(The chief items for one set of kites are as follows:—

1 fair weather pilot kite.
1 heavy weather pilot kite.
7 lifter kites.
2 carrier kites.

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Brake trolley.
Kite triangle.
2,000′ of music wire, 18 S.W.G.).
54 filled gas tubes, being fills for 2 balloons, with some over for replenishing.

In addition to the articles carried in the field, the 1st Reserve of Technical Stores mobilizes with the unit and accompanies it as far as the Advanced Depôt.

The chief articles carried are :—

Four 11,500-cu. ft. balloons complete.
Two 4,500-cu. ft. balloons complete.
146 gas tubes=6 fills.
Spare cable.
Complete set of kites and
Spare fittings for same.

FIELD SEARCHLIGHT COMPANY.

In the event of this company, which is at present experimental, being mobilized for service it would form part of the Field Army as opposed to

(*a*). Coast Defence E.L. Companies, for the defence of harbours and the night fighting of coast batteries.
(*b*). Fortress or Siege E.L. Companies, which will have mobile plant, but are intended only for the attack or defence of fortresses on the land fronts.

The proposed organization is on the lines of a Royal Field Artillery battery, and consists of six "power units," divided into three sections of two power units per section.

The power units consist of a projector wagon and a generator wagon. The projector is carried on a limbered wagon, the projector itself being mounted on the trailer, and the drum of cable and spare parts and stores on the limber. The projectors are either 3′ or 2′ in diameter. This wagon requires a 4-horse team. The generator wagon contains dynamo, engine, fuel oil, and water for 10 hours' work, and requires a 6-horse team.

The dismounted detachment to work each light and engine, and to control it by telephone, is six non-commissioned officers and sappers, four of whom are carried on the projector wagon and two on the generator wagon.

In addition to its two larger projectors, each section of two power units has three or four smaller (1′) projectors, to be carried on one or two carriages, which are not at present decided on. These three or four small lights can be used as an alternative to either of the large projectors, making use of its engine power.

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Establishment of a Searchlight Company.

	Officers.	N.C.O.'s and Men.	Horses.	Vehicles.	No.
Peace ...	3	88	45*	Projector wagons ...	6
				Projector wagons, small	12
				Generator wagons ...	6
				G.S., R.E.	3
War ... (proposed)	5	168	134	Projector wagons ...	6
				Projector wagons, small	12
				Generator wagons ...	6
				G.S., R.E.	5

* Excluding officers' horses.

The proposed war establishments of such a company includes a second relief of six sappers for each light. These men march on foot with the headquarters of the company.

Each section has also a stores wagon (G.S., R.E.) for such spare mirrors, etc., as cannot be carried on the projector wagons.

General Principles of Employment.—Field searchlights can be employed as follows :—

(*a*). On the defence.

(1). To light with concentrated beams defiles across which the attackers must advance, so that they may be fired on with effect by the guns of the defence at ranges up to 3,500 yards.

(2). To light up the attacking infantry with dispersed beams when advancing to the assault at ranges within 1,000 yards.

(*b*). In the attack.

(1). To prevent the defence from improving their entrenchments and obstacles under cover of darkness.

(2). To light up definite artillery targets, such as redoubts.

(3). To assist the attacking columns by lighting up rough ground with diffused lights, so that the rate of advance in the initial stages of the attack may be as rapid as by day.

(4). To help the attacking columns to keep direction by lighting with concentrated beams that part of the defenders' line selected for assault.

(5). To assist in repelling the counter-attack.

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Searchlights can also be used to assist with light all operations such as bridging, pontooning, and entrenching, when not in the face of the enemy and when it is desirable that these works should be carried on night and day.

Position.—Positions both in attack and defence which are suitable for guns to fire "over the sights" will generally be suitable for searchlights, but lights are usually more dispersed than guns.

Proportion to Other Arms.—A company of six lights can, as a rule, cover the frontage of two brigades in the firing line, so a proportion of one company per division would seem to be about right.

RAILWAY COMPANIES.

There are three railway companies, 8th, 10th, and 53rd, all these being stationed at Longmoor (Aldershot Command).

They are employed on the construction and maintenance of the Woolmer Instructional Military Railway, a 4′ 8½″ gauge military line, some 6 miles in length, connecting Bordon (L.S.W.R.) with Longmoor Camp, including workshops for repairs to rolling stock, etc.

Officers are also trained in railway reconnaissance and survey while at Longmoor, three N.C.O.'s and men per company being also instructed in railway survey work. Parties, each commanded by an officer, are sent out to carry out a reconnaissance and final location of a railway between two points about 40 miles apart, on the assumption that it is an unmapped country. Complete plan and sections are drawn out.

A certain proportion of the men undergo at present courses of "fitting" and "firing" on civil railways. The "fitting" course usually lasts nine months and the "firing" course six.

For service abroad the railway companies form part of the lines of communication troops.

In time of war the duties of a railway company would be to survey, construct, repair, and demolish railways, and to work construction and armoured trains.

The "working" of an existing railway, *i.e.*, the traffic and locomotive work on an open line, will seldom be required of a railway company in war time. For such work larger and differently organized units are necessary. War Establishments, 1908–09, include the following units intended for such work, but these have not yet been formed in peace time, viz.:—

Railway Control Establishment.
A Central Railway Establishment. } Forming one Railway
2 Railway Districts. } Corps.

When however a railway has been made, practice is given in working it.

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The peace training is therefore on the following lines:—Reconnaissance, survey, and final location of a railway; platelaying; laying out station yards; laying out deviations; rapid laying of narrow-gauge tramway; railway bridging of all kinds; signal installation; water supply; repairs to telegraphs and telephones necessary for working construction lines; working of electric block instruments; armouring trains; construction of temporary platforms; working and maintenance of construction trains.—*Corps Memo.*, No. 620, Part II., Appendix V., p. 97.

Men enlist for three years with the Colours and nine years in the Reserve (*Recruiting Regulations*, 1909, p. 22), but those selected for special courses of instruction should invariably extend their service or re-engage if eligible, or, if not eligible by length of service, etc., must express their willingness to do so as soon as they become eligible. This should be stated on Army Form B 251, if they have less than three years to serve on their present engagements.—*Corps Memo.*, No. 620, Part II., para. 311.

The establishment of the railway companies in peace and war is as under ("Regimental Establishments, 1909–10," pp. 22 and 23; "War Establishments, 1909–10," p. 134):—

	(*a*). Peace.		
	Officers.	N.C.O.'s and Men.	Horses.
8th (Railway) Company ...	3	76	—
10th (Railway) Company ...	3	77	—
53rd (Railway) Company ...	3	76	—

	(*b*). War.			
	Officers.	N.C.O.'s and Men.	Horses.	Vehicles.
8th (Railway) Company ...	7	247	4	1*
10th (Railway) Company ...	7	247	4	1*
53rd Railway) Company ...	7	247	4	1*

* Cart, forage, for technical equipment.

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The establishments by trades of the dismounted rank and file of a railway company are as under :—

One Railway Company.	Peace.	War.
Blacksmiths	5	15
Boilermakers	2	8
Bricklayers	—	4
Carpenters and Joiners	9	41
Clerks	—	2
Collarmakers	—	1
Coppersmiths	—	4
Draughtsmen (Mechanical)	—	2
Electricians	1	2
Engine Drivers, Field	22‡‡	30§
Fitters and Turners	15	40
Instrument Repairers	—	1
Masons (Builders)	—	6
Masons (Stonecutters)	—	2
Moulders	2	4
Painters	—	1
Platelayers	4	9
Plumbers and Gasfitters	—	4
Riveters	9*	21
Sawyers	—	6
Shoemakers...	—	1
Signal Fitters	—	2
Surveyors	—	4†
Tailors	—	1
Telegraphists (Office)	—	1
,, (Permanent Line)	—	2
,, (Field Line)	—	2
Tinsmiths	—	3
Wheelwrights	—	2
Whitesmiths	—	3
Total	69‡‡	230§

* 8th Company, Royal Engineers, to have 1 tailor and 1 shoemaker in lieu of 2 riveters.

† From the Ordnance Survey. They should be men thoroughly acquainted with the theodolite and level, ordinary topographical work, and drawing.

‡‡ In addition to the engine drivers, 8 sappers of suitable iron trades to be trained in "firing" duties.

§ In addition to the engine drivers, 14 sappers of suitable iron trades to be trained in "firing" duties.

The question of stores, other than technical, to be carried by the railway companies in the field depends entirely on the theatre of operations, and would be varied to suit the conditions of each locality, from information obtained beforehand.

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For peace training a supply of all plant required for railway work is sanctioned and maintained at Longmoor.

For instance :—

Broad Gauge.—Locomotives, 3 ; rolling stock, 59 vehicles.
Narrow Gauge.— „ 1 ; „ various.
Rails.—9 miles (60 lbs.), single track.
Sleepers.—18,000.
Bridging Timber.—12″ × 12″, 10,000 F.R., together with a liberal supply of other timber, such as 18″ × 9″, 16″ × 9″, 9″ × 3″, 12″ × 3″, 12″ × 6″, and 6″ × 8″.

ROYAL ENGINEER L. OF C. UNITS.

Unit.	Place of Mobilization and Personal Equipment.*	How Allotted on Mobilization.
Railway Company ...	Longmoor Camp.	L. of C. Troops.

* Owing to lack of storage accommodation at Longmoor, the Reservists' clothing, etc., is at Aldershot; the arms, accoutrements, and technical equipment are at Chatham. Ultimately these will be stored at Longmoor.

A.F.G. 1098—36 is the Mobilization Store Table for a railway company.

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R.E. WORKS ABROAD.

A SUGGESTION.

By CAPT. E. H. HARVEY, LATE R.E.

IN the course of an R.E. officer's service in peace time, as well as during active operations, one of the most notable features in his work is the great diversity of the local conditions affecting the method of its execution and of the materials employed, especially on foreign service. Whenever he joins at a colonial station he is called upon, at comparatively short notice, to deal with conditions and local necessities more or less new to him, and until he actually arrives at the station itself there is not, so far as I am aware, any compact and easily accessible source of information, such as exists at home in the form of numerous builders' handbooks, and of the Barrack Synopsis.

Accounts of great interest and value of recent works in India and elsewhere are published at times in the *R.E. Journal* and *Professional Papers*; but the idea of helping officers proceeding abroad for division and ordinary duties, by publishing a series of short compact accounts of the "works conditions" of the various stations, similar to the Descriptive Accounts that deal with more general and personal information, seems to be well worthy of consideration.

I should not suggest that India be included in such a compilation—as that country has its own varied conditions, but that the accounts should be drawn up for the other colonial and foreign stations where the R.E. are normally stationed, leaving the question of works in India to those in authority there, and to the officers employed by them.

The form in which the information might perhaps be published would be in a book somewhat similar to the Barrack Synopsis or Drainage Manual, as being preferable to a series of small pamphlets, and more suitable for a D.O.'s office table. The book—including various sections for the various stations—might, if necessary, be in two parts, say "Eastern" and "Western." It might include a few line plans and elevations of local types of building, if space allowed, and in the case of the smaller stations a rough sketch-map to indicate the relative positions of the military stations and R.E. offices (omitting of course detail and information shown in the regular maps).

In regard to the headings under which the information is collected, I should suggest the following:—

Climate and soil, the former with special reference to siting questions; the prevailing winds; the general character, seasons, and duration of storms, as affecting the aspect of buildings on exposed

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sites; the special liability of any localities to frequent damage by wind or lightning; and the rainfall.

The *general type* of *European houses* as provided by local authorities or built privately, with regard to size of verandahs, cubic air space, and usual dimensions of rooms, etc. The importance of ample verandah space—well known to all who have served in the tropics—with room for sleeping, might be most strongly emphasized, and also the absolute necessity in many cases of "chicks," and, in exposed sites, of strong shutters to keep out violent rains. Again, the need in certain localities of each quarter having its own bath-room, and the nature of the sanitary arrangements and drainage. I do not mean that such requirements are not largely known, but I venture to think that they might be very clearly laid down, for the stations that are concerned, as a guide to officers entering upon new duties in a strange locality, and having perhaps to prepare designs at once.

Local building materials would naturally claim an important section; the names, nature, and characteristics of local timber, the quality of brick and stone procurable locally, and any special local roofing materials, such as "attap," for instance, with its average "life" and cost. The district "Schedules" of course contain this, but a good deal of the information (in general terms) might conveniently exist in the form I suggest, not only for the private use of officers when changing station, but also for the use of those whose duty it is to overlook projects from a distant station.

Suitability of special building materials, patent roofings, wall coverings, etc., to the climate in question might be a useful heading if the information could be conveyed without prejudice to the manufacturers.

Information in regard to any local colouring materials, paint, and so forth, roadmaking materials employed, nature of existing local drainage, water supply, fire protection, and conservancy might be briefly mentioned; where barracks exist in, or close to, large cities and towns; also the lighting in use, whether gas, oil, etc., and whether coal or wood is used for fuel.

The approximate time of transit of *stores* from home, and their method of delivery to the R.E. divisions. The local means of transport, with any peculiarities.

Finally, the *working hours* and general customs of the natives who may usually be employed on the works—a matter of some importance where different races find employment side by side in the same division. The trades in which special skill or otherwise is found locally.

These points could of course only be touched upon very briefly, much in the style of the Descriptive Accounts which I have referred to; but I think that such a compilation as I have suggested might be prepared locally without great difficulty in most stations, sufficient at least for the purpose of giving officers a reference book, and if interleaved with plain paper to a limited extent, could be revised or corrected as necessary by those using it, and generally kept up to date.

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WIRELESS TELEGRAPHY.

By LIEUT. A. C. FULLER, R.E.

MY excuse for writing this article is as follows:—There must be several officers who, having passed through the R.M.A. and the Chatham courses before wireless telegraphy was of practical importance, have since been unable to give up the necessary time to enable them to acquire a working knowledge of this most interesting subject. There are of course several excellent and standard works on the subject written by the most able scientists of the day, but most of them are of an advanced nature and deal largely in mathematical proofs of theories now universally acknowledged.

To extract the main practical points from such works requires a considerable outlay of time and trouble, and the object of this article therefore is to save this by attempting to bring them out—generally without proof or detailed explanation.

Whenever a spark (which may be termed a snap spark in differentiation from an arcing spark) occurs, electric waves are propagated through the surrounding medium. These waves travel with the velocity of light, and they can be refracted, reflected, and brought to a focus, as light waves can, by the interposition in their path of suitable arrangements, but these properties have not at present any very direct bearing on the principles of wireless telegraphy. A fact of primary importance however is that every electric wave has a definite length, and waves have been produced with a length of a few centimetres only, and can be created with a length of several hundreds of miles.

The length of wave depends on two properties of the circuit in which the snap spark occurs, viz., on its capacity and its inductance. The wave lengths in common use are of 600 and 300 metres, and these are the lengths laid down for universal use by the Berlin Radiotelegraphic Convention.

The next point to consider is how these waves are produced for practical wireless telegraphy. The essential point is that the discharge made manifest by the snap spark should be oscillatory.

To obtain a physical oscillation, what Dr. Fleming terms a "self-restoring displaceability" is required, and this displaceability must have mass or inertia. A weighted spring, for example, is capable of oscillation since it has both these elements. In a similar way for electrical oscillation, electrical stretchability—if the word may be used—is required, and also electrical inertia, and these two are the equivalents of capacity and self-induction—or inductance.

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The behaviour of a weighted spring is worth attention, and its oscillations under varying weights and displacements give an insight into electrical oscillation under varying conditions of inductance and capacity.

Further, in order to break down the insulation of the air and to allow the spark to pass, it is obvious that a very considerable electrical pressure is required. Dr. Fleming states that to produce a spark of only 1 c.m. in length requires 30,000 volts.

It will be seen therefore that the essentials to produce these electric waves are :—

(1). A circuit of low resistance made up of capacity and inductance in series with a spark gap.

(2). A means of applying the necessarily high electrical pressure.

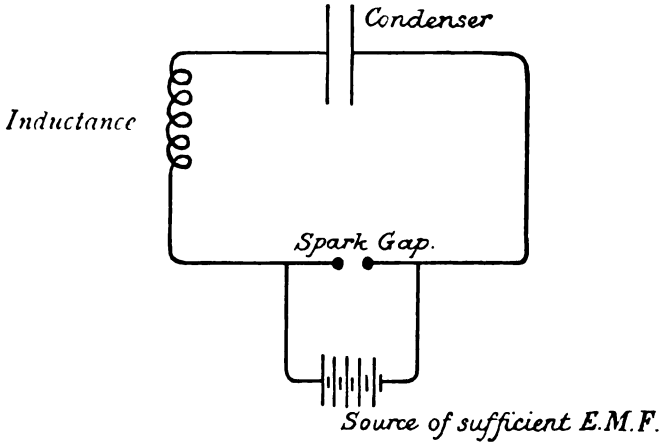

FIG. 1.

The fact that oscillations do occur in such a circuit has been proved beyond question, the oscillatory spark having frequently been photographed. These oscillations do not last for ever, but die away, like those of a displaced spring, whose oscillations gradually decrease in amplitude till the spring comes to rest. The term "damped" is applied to those oscillations which die away more rapidly, and "undamped" to those that are more prolonged. If we consider a swinging pendulum, we know that left to itself it will cease to swing. As the energy of a swinging pendulum is dissipated by friction, by overcoming the resistance of the air, etc., so the oscillations of the electric discharge gradually die away, the energy in this case being dissipated in the following ways :—

1. By heating the dielectric of the condenser.
2. By generation of heat owing to the resistance of the oscillation circuit itself.
3. By inducing currents in neighbouring conductors.
4. By the generation of electric waves travelling out into space in all directions.

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For purposes of distance signalling, it is obvious that No. 4 is the most useful outlet for the energy of the discharge.

It is also evident that where the discharge circuit is arranged to have great radiation, the energy is rapidly dissipated, and the oscillations therefore are heavily damped, and the wave train is of very short duration.

The simplest practical arrangement for the production and radiation of these waves is as shown in *Fig.* 2 :—

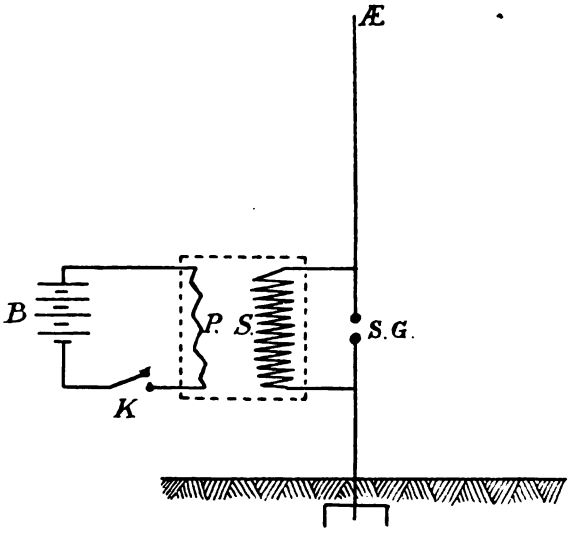

FIG. 2.

B is an accumulator battery or other source of power.

K is a key.

PS the primary and secondary of an induction coil used to obtain the necessary voltage.

SG the spark gap.

Æ the aerial wire which contains in itself an inductance, and has a capacity in relation to the earth.

An arrangement such as this has good radiating power, but its oscillations are heavily damped. This was the original Marconi arrangement. A circuit such as illustrated is termed an open circuit with plain aerial, and the discharge therefrom is often termed a whip-crack discharge.

Before following this subject any further a few words are necessary on "electrical tuning," first developed by Sir Oliver Lodge. Every oscillation circuit has what is termed an oscillation constant, dependent upon the values of its resistance, inductance, and capacity, and the length of the wave radiated is dependent on this oscillation constant. Now a sending circuit can be adjusted, by alteration of its capacity and inductance, to radiate waves of any length within limits;

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and this alteration of capacity and inductance, or either of them, can easily be effected with suitable instruments. A suitably equipped station can therefore radiate waves of a known and predetermined length. The following is a good analogy to electrical tuning. The human ear is sensitive to, and able to receive, a wide range of sound waves, the reason being that its natural vibrations are heavily damped, *i.e.*, it is not a persistent vibrator. On the other hand, a tuning fork, which is a persistent vibrator, will respond only to a note in tune with it, *i.e.*, to some sound-producing body with the same oscillation constant. If a persistent vibrator is exposed to the waves emitted from another persistently vibrating body of a different oscillation constant, one wave arriving will counteract, or at any rate oppose, some other of the train, and the effect will be to render the receiver incapable of steady vibration. That is to say, a persistent vibrator will readily respond to another only when in tune; it will however respond over a much wider range to a heavily-damped vibrator, though the wave received to set the oscillation in motion must in this case be much more powerful.

The effect of two tuned persistent oscillators can best be compared with the effect that a series of pushes or impulses, properly timed, will have on a swing. If the swing receives a single impulse of great power, it may reach the same amplitude. This is the case of a heavily damped radiator. If however a series of pushes are given, not properly tuned, it is obvious that the swing will attain no great amplitude, and will merely receive a series of jerks, one acting against another. This is the case of a persistent oscillator exposed to the radiations of another out of tune with it.

In the case of the timed impulses, the longer the impulses continue the greater becomes, up to a limit, the amplitude of the swing, and this is the key to the sensitivity of syntonic or tuned telegraphy, where it is the cumulative effect of incoming impulses which finally operates the receiving arrangement. It must of course be understood that the time taken in this accumulation is infinitesimal.

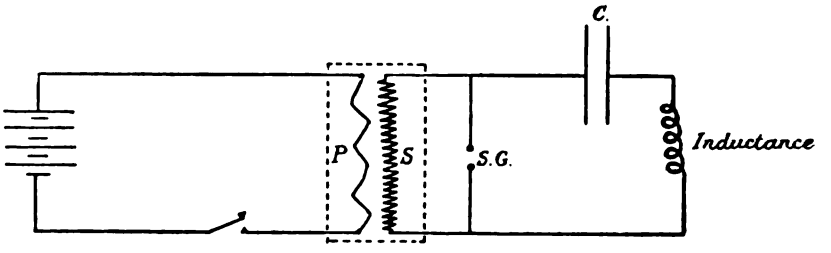

FIG. 3.

In *Fig.* 3 the circuit has all the necessary conditions for oscillation, but very little radiating power; hence the oscillations are only slightly

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damped. If now it has inductively coupled with it another with the same oscillation constant and considerable radiating power, an efficient sender for wireless telegraphy has been provided.

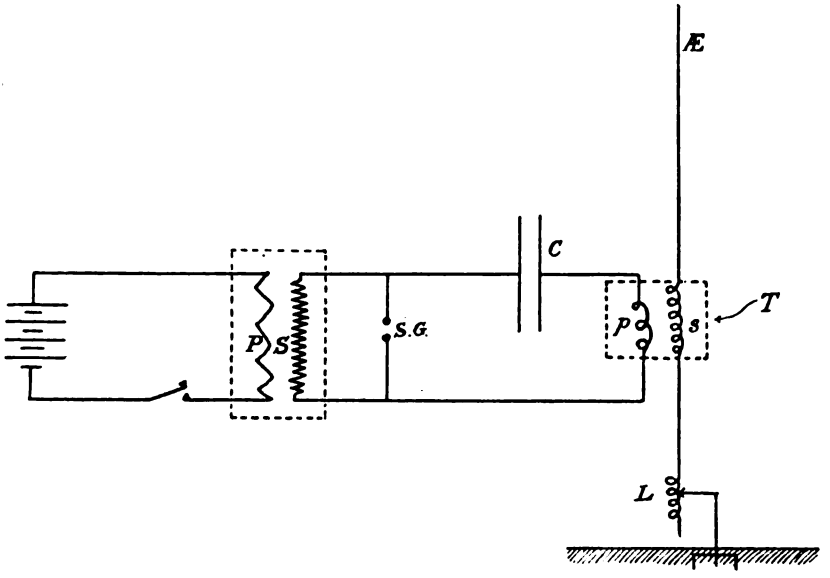

FIG. 4.

In *Fig.* 4, the portion marked T is an oscillation transformer, whose action is purely inductive; *p* and *s* are the primary and secondary coils respectively of this transformer. The object to be attained is good radiation, with persistent or slightly damped oscillations. The condenser C generally consists of a battery of Leyden jars. Referring to this arrangement, Dr. J. A. Fleming says: "The circuits are more or less closely coupled by varying the distance between the primary and secondary (of the oscillation transformer). By the adjustment of the variable inductance L between the earth plate and the secondary circuit of the oscillation transformer, and by variation of the capacity of the condenser in the primary circuit, the two circuits are brought into resonance (or tune) with each other. When oscillations are set up in the closed circuit by the discharge of the condenser, the energy stored up by the Leyden jars is gradually drawn off and radiated by the open circuit. The closed circuit then forms a reservoir of energy, and is in itself a slightly damped circuit or persistent oscillator. The open circuit is a good radiator and is kept supplied with energy from the reservoir. Hence we have a much more persistent train of oscillations set up in the aerial at each discharge than would be the case if the only storage of energy were that due to the small capacity of the aerial."

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From the above it will be seen that the means exist of radiating persistent trains of waves, and these can make themselves felt on suitably tuned receivers. It remains to consider how these waves are detected.

There are various classes of detectors, the earliest to be used practically being of the filings type.

When metallic filings are in loose contact, they offer an enormous resistance to the passage of an electric current. It has been found however that the effect of Hertzian waves falling on them is to greatly reduce their resistance and thereby to enable a current to flow through them. Here therefore is a detector. Sir Oliver Lodge gave this phenomenon the name of coherence, and the glass tube in which the filings are generally arranged is now known as a coherer. Once having been affected by a wave, the filings remain in their state of coherence, or lowered resistance, until they receive a mechanical jar or tapping back, termed decoherence. This need for decoherence is a practical drawback to the use of this type of detector, for, in order to receive a series of signals, some tapping-back device must be arranged, thus introducing a complication in the receiver.

Almost any loose contact is improved as a conductor by the reception of Hertzian waves, and perhaps one of the most sensitive of all detectors is the Lodge's single-point coherer (*Fig.* 5).

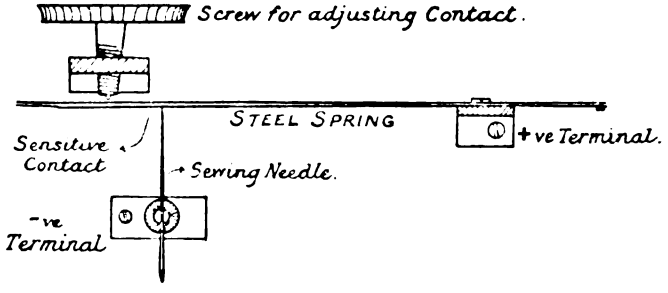

FIG. 5.—*Plan of Single Point Coherer.*

This coherer will work without any decoherence, but is uncertain in action, for the contact has to be extremely light and accurately adjusted for good results, and an extra strong impulse will sometimes put it out of action.

Wireless telegraphy is also indebted to Lodge, Muirhead, and Robinson for their wheel coherer (*Fig.* 6), which is certain in action and very reliable and sensitive. The disadvantage is, however, that it requires clockwork to drive it, at once introducing a further complication.

This coherer consists of a steel wheel with a very fine, almost razor-like, edge. This wheel is made to revolve with its edge just making

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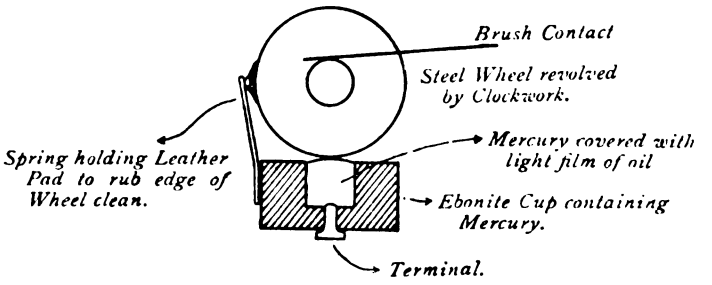
Brush Contact
Steel Wheel revolved by Clockwork.
Spring holding Leather Pad to rub edge of Wheel clean.
Mercury covered with light film of oil
Ebonite Cup containing Mercury.
Terminal.

FIG. 6.—*Sketch to show Wheel Coherer.*

contact with mercury covered with a light film of oil, and held in an ebonite cup. The oil prevents good contact between the disc and the mercury, but when a wave falls on the coherer, the oil is perforated and a current from a shunted cell (see later diagrams) can pass momentarily. The wheel revolving draws in the oil again and the contact is broken. A slight milling on the edge of the wheel is said to be an improvement to this coherer.

Marconi devised in 1902 two forms of magnetic detector. These detectors depend, for their action, on the power of Hertzian waves to magnetize iron. A magnetic detector of Marconi's latest pattern is an extremely sensitive form, and is used for long distance telegraphy.

Another recently developed form is the crystal detector. A mass of carborundum crystals, held between spring clips of metal, is found to act as a detector. There are two ways in which this detector can operate :—

(*a*). The crystal is possessed of a unilateral conductivity, *i.e.*, it will allow a current to pass through in one direction and not in another; hence it will rectify the oscillations received and allow them to pass through as a direct current.

(*b*). The crystal has a curved characteristic and does not obey ohms law, as the following diagram shows (see *Fig.* 7), *i.e.*, the conductivity is a function of the voltage.

This crystal (with certain others) can be used without a local cell to convert oscillations into direct current to affect a telephone or galvanometer. Also, since the conductivity is more increased by the addition of voltage than decreased by the subtraction, oscillations are plainly heard in a telephone in series with a local cell and the crystals (see later diagrams).

This crystal forms a most useful detector, and has been much used by the writer; once adjusted to the correct pressure between the clips with the correct voltage, it requires no attention, and remains ready for use for an unlimited time. I am unable to give any definite figures as to its sensitivity, but should this be satisfactory it appears

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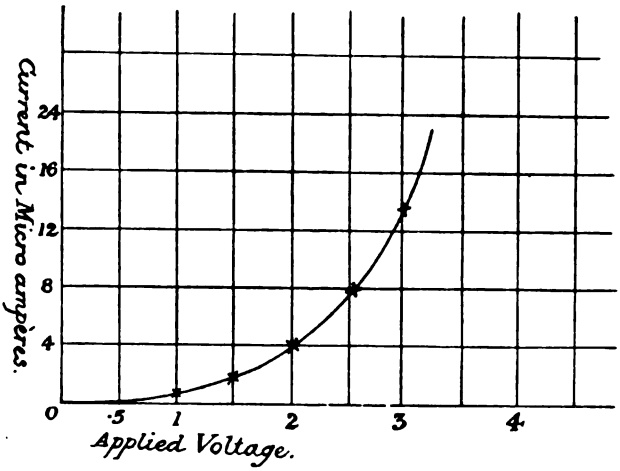

FIG. 7.

an ideal detector for military requirements. Other detectors are those dependent on thermal effects, but the writer has had no experience of these, and does not propose to describe them.

Another, and perhaps the most generally useful type of detectors, are those known as electrolytics. They depend for their action on the power of oscillations to depolarize any very small metallic or carbon surface immersed in an electrolyte. These detectors are made in many forms. An ordinary form is as follows :—

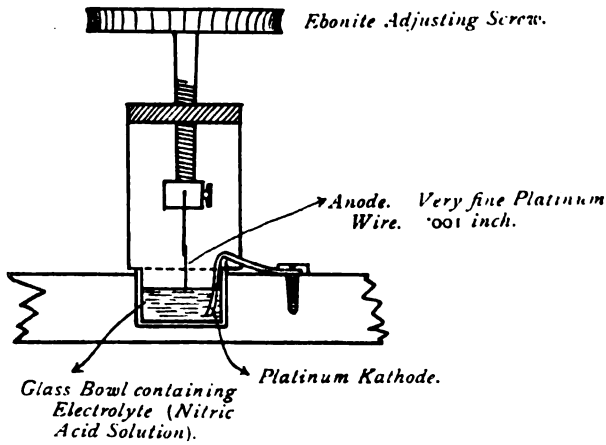
Ebonite Adjusting Screw.
Anode. Very fine Platinum Wire. ·001 inch.
Platinum Kathode.
Glass Bowl containing Electrolyte (Nitric Acid Solution).

FIG. 8.

On passing a current through this detector from a shunted cell the electrodes become polarized, and the current ceases, or nearly ceases, to flow. The reception of a wave depolarizes the anode, thereby reducing the resistance of the detector and momentarily allowing a current to pass, which again sensitives the detector by repolarizing the anode.

There are other forms of detectors in great numbers, but the types

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given are those commonly met with. It is interesting to notice how the three main effects of an ordinary direct electric current have been utilized for the detection of these electric waves. In order to be affected and to render manifest signals, these detectors must be inserted in a suitable circuit.

The following diagrams show circuits suitable for the various classes, the oscillation circuit being shown in heavy lines.

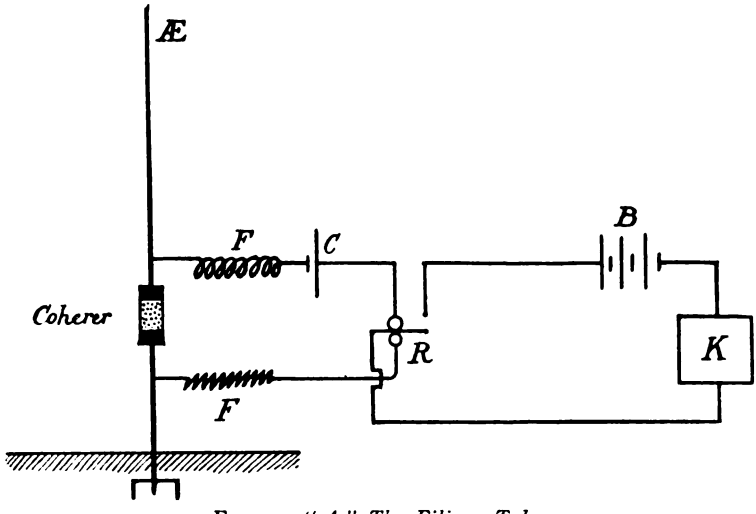
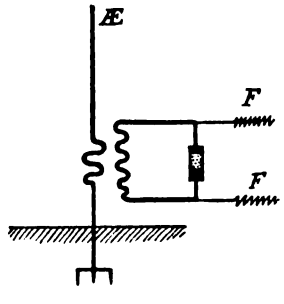


FIG. 9.—"*A.*" *The Filings Tube.*

FF are choking coils to confine the oscillations to the oscillation circuit only, and to prevent their energy from being wasted in the other parts of the receiving arrangement. C is the cell which passes a current through the coherer when it is rendered conductive by the reception of a wave. R is the relay worked by the current from C, and this relay in its turn closes the circuit of B (henceforward termed the manifestor circuit) and operates K, which may be a Morse printer, a siphon recorder, or any device to record the reception of the wave train. No tapping or decohering device is shown in the diagram.

There are many modifications of this circuit, and Marconi improved it by inserting a jigger, or specially designed oscillation transformer, therein, the object of which was to step up the impulses and minimize slight atmospheric effects.



Same as Fig. 9.

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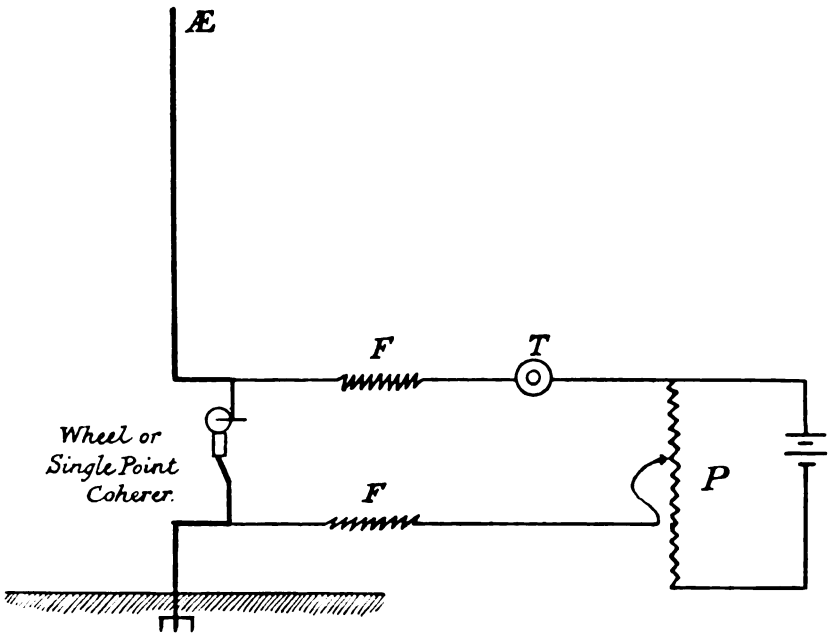

FIG. 10.—"*B.*" *Single Point Coherer. Lodge Muirhead Wheel.*

In this arrangement a telephone, T, is the manifestor, and no relay is necessary. The carborundum crystal detector can also be used on this circuit, but would usually have a jigger to step up the impulses.

P is a potentionmeter for regulating the voltage applied.

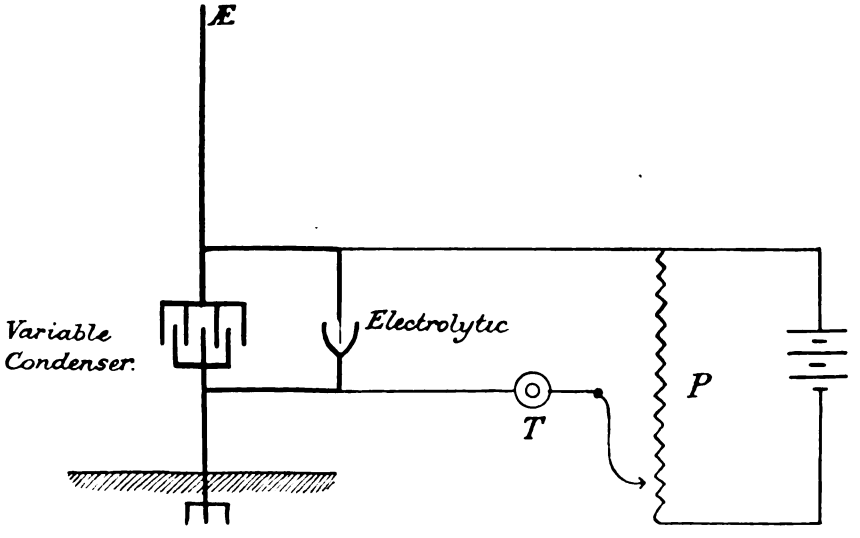

FIG. 11.—"*C.*" *The Electrolytic Detector.*

Here again a telephone is the manifestor, and no relay is required. In this circuit, the less of the anode there is in the electrolyte, the

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more sensitive the device becomes. The voltage must be adjusted to be just sufficient to pass a current through the detector, which current can be heard as a slight roar in the telephone. This roar must be reduced to a minimum when the detector is adjusted for reception.

Any of these circuits will respond readily to a heavily damped radiator, that is to a whipcrack discharge, if the distance is not too great ; and at short ranges they will respond to radiators having a wide range of oscillation constants, *i.e.*, they are sensitive to various wave lengths.

It has been found however that they will respond at much longer ranges to radiators in tune with themselves, *i.e.*, with those having the same oscillation constants or wave length.

Further, it has been shown that if the radiator sends out persistent wave trains or lightly damped oscillations, then the distance at which a syntonized receiver will respond is yet further increased.

In order for a receiving station to be able to respond to waves of various lengths, its oscillation circuit must be equipped with arrangements for regulating the capacity and inductance, *i.e.*, with variable condensers and coils with sliding contacts to vary the inductance.

The following are the advantages of a tuned system of wireless telegraphy :—

(*a*). For a given power a tuned station can receive messages from two to three times as far (or more) as an untuned one can.

(*b*). Other untuned stations cannot receive the messages, even though considerably nearer the sender.

(*c*). Messages from an untuned station do not interfere with and render unreadable the signals from the distant tuned station, even though the latter is much further off.

The extent to which these advantages hold, depends upon the "sharpness of tuning" of which the system is capable. Circuits have been devised which will respond to their own wave length, but utterly fail to accept a signal with a difference of even 1 per cent. in the wave length ; that is, they will respond to a 600-metre wave and be in no way affected by one of 593 metres.

The methods employed for power generation are either :—

Direct current from accumulators or power mains. { With induction coil and some form of interrupter.

Or

An alternator, driven by oil engine, turbine, or other source of power. { With an alternate current transformer.

Many types of aerials also are employed, and in all cases the same aerial, or portions of it, are used for receiving and sending. The commonest forms of aerial are as shown in *Fig.* 12 :—

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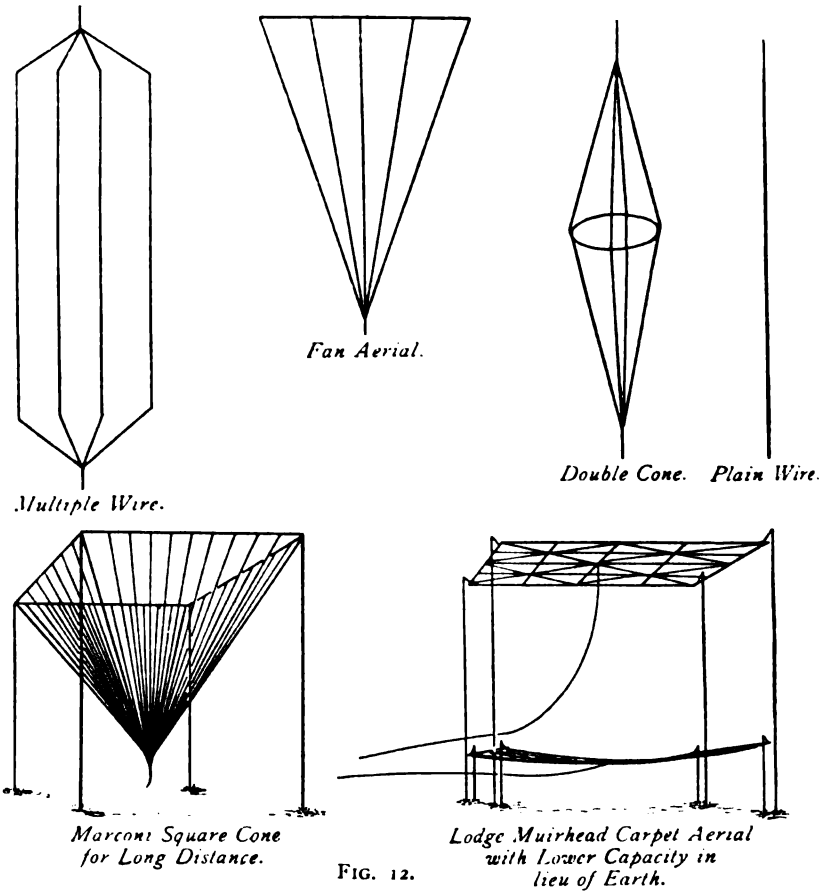
Multiple Wire.
Fan Aerial.
Double Cone.
Plain Wire.
Marconi Square Cone for Long Distance.
Lodge Muirhead Carpet Aerial with Lower Capacity in lieu of Earth.

FIG. 12.

In conclusion, the following diagram shows a complete practical arrangement for transmission :—

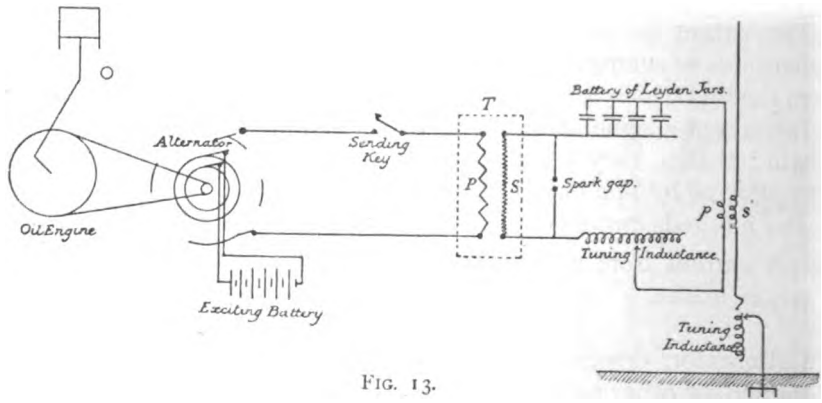

FIG. 13.

In the above diagram T is the alternate current step up transformer, and *ps* primary and secondary of oscillation transformer.

It is also worth noting that a small exciting dynamo driven from O would be a better arrangement than the exciting battery.

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THE FYERS FAMILY.

(Continued).

By Col. Robt. H. Vetch, c.b., late R.E.

Children of Major-General Peter Fyers, c.b., Colonel Commandant, R.A.

By his marriage with Frances (born 1791, died 1867), fourth daughter of John Bolland, M.P., of Mark Lane and Clapham, and of Elizabeth, his wife, daughter of Mr. Gipps, of Hythe, Kent, M.P. for Ripon, which took place at Clapham on the 7th November, 1812, Major-General Peter Fyers had four children, viz.:—

1. Henry Thomas Fyers, Captain, R.A., and Lieut.-Colonel Commanding Royal Lancashire Artillery Militia (see below).

2. William Augustus Fyers, Lieut.-General, K.C.B., Colonel of the Durham Light Infantry (see below).

3. Charles Peter, born at Woolwich, 29th August, 1816, and died in childhood (1820).

4. Elizabeth Catherine, born at Edinburgh on the 21st May, 1827, died at Yateley, Hants, unmarried, on 3rd October, 1907.

Lieut.-Colonel Henry Thomas Fyers, Royal Artillery.

Henry Thomas Fyers, the eldest son of Major-General Peter Fyers, was born at Woolwich on the 25th January, 1814. He joined the Royal Military Academy at Woolwich as a Cadet on the 14th April, 1825, and was commissioned as a 2nd Lieutenant in the Royal Artillery on the 26th July, 1831. A year later he was promoted to be 1st Lieutenant. From July, 1840, he was Secretary of the Royal Artillery Institution at Woolwich for a year. He was promoted to be 2nd Captain on 13th April, 1842, and 1st Captain on the 13th April, 1847. He retired on half-pay two years later. He then, as a Captain, joined the Royal Lancashire Artillery Militia, of which he eventually became Lieut.-Colonel Commanding. He died, unmarried, at Kensington on the 21st July, 1886, and was buried at Kingswood, Surrey.

Lieut.-General Sir William Augustus Fyers, K.C.B., Colonel of the Durham Light Infantry.

William Augustus Fyers, second son of Major-General Peter Fyers, was born at Woolwich on the 2nd July, 1815, shortly after his father had been appointed to the command of the Rocket Brigade. He was educated at the Edinburgh Academy, where he acquired a taste for mathematics, science, and drawing, and an aversion to classical literature. Here he learned to fence, and he became a very expert swordsman, and as he grew to a height of 6′ 4″, he was not very easy to approach. On October 17th, 1834, he was commissioned as Ensign

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in the 40th Foot, and in June of the following year he sailed with the regiment for India. He was promoted to be Lieutenant in May, 1830.

Fyers had been quartered with his regiment for some two years at the sleepy little station of Disa, in the north-west of Gujerat, when they heard with joy of what they hoped would be a prospect of active service. On the 1st October, 1838, Lord Auckland, the Governor-General of India, had issued his famous "Declaration" on the subject of Afghanistan. Intrigues had been set on foot by Russia at the Courts of Teheran and Kabul, which threatened the interests of British India; Dhost Muhammad, at Kabul, and his brothers, who held sway at Kandahar, were in agreement with Persia in the line of policy to be pursued; while the British envoy, Sir Alexander Burnes, had returned from a commercial mission to Kabul, which had proved a complete failure. Moreover, Persia had attacked the Khan of Herat and was besieging the city of Herat, assisted openly by Russian officers and Kabul and Kandahar Afghans.

The "Declaration," or "Manifesto of Simla," as it was sometimes called, set forth how seriously the policy of the Afghan chiefs was opposed to British rights and interests, and declared the intention of the Government to replace Shah Shuja on the throne of Afghanistan, from which he had been driven in 1809.

Since that date, as a matter of fact, Shah Shuja had made repeated and unsuccessful endeavours to recover the throne, the country since his expulsion being parcelled out amongst the Muhammadzai Sardars.

In pursuance of the policy of the "Declaration," measures had been already taken by the Government of India to send a large force to Afghanistan. Two divisions of the Bengal Army were assembled at Firozpur by the end of November, 1838, and a Bombay division was sent at the same time to the mouth of the Indus, whence it marched to Haidarabad. In December the 40th Regiment was ordered to hold itself in readiness to proceed to Lower Sind. Great excitement prevailed, as it was hoped and expected that the regiment was to form part of the Bombay Division. All the heavier was the disappointment which ensued when it was found that the 40th was to form part of a reserve force to be assembled under Brigadier Valiant, K.H., who had been commanding the regiment, and was to be stationed in Lower Sind, with headquarters at Karachi, then held by Baluchis.

On leaving Disa, on 4th January, 1839, the regiment, mustering 650 bayonets, marched to Mandavi, on the coast of Kach, some 240 miles distant. There they arrived on the 27th January, to find awaiting them H.M.S. *Wellesley* (74), bearing the flag of Rear-Admiral Sir Frederick Maitland, one of the Company's steamers with the 2nd Bombay N.I. on board, the transport ship *Hannah*, and a fleet of country boats for the conveyance of stores, ammunition, etc. A company of Bombay Artillery was also there. Fyers embarked with his regiment, under Lieut.-Colonel Powell, who had just arrived to

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take command, on board H.M.S. *Wellesley*, and the artillery on the *Hannah*. The next day the Admiral set sail for the Hajamro, mouth of the Indus, and, anchoring there, was joined by H.M.S. *Algerine* and two of the Company's cruisers.

On the evening of the 31st January orders came that the force was "to proceed to Karachi and take it," and the following evening the flotilla anchored off Manora Fort at the entrance to Karachi Harbour. Next morning H.M.S. *Wellesley* cleared for action, and the fort was summoned by a flag of truce sent ashore. The commandant of the fort replied, "I am a Baluchi, and will die first." The artillery and a wing of the 40th were then disembarked on the western side of the fort, under cover of H.M.S. *Algerine* and of the Company's ship *Constance*, which stood in for the purpose. A second flag of truce was then sent, but the sturdy commandant, although he knew that the fort must fall to such a strong force, replied in the same strain as before: "The fort may be stormed, but will never be surrendered," and without further parley he opened fire. The remainder of the 40th was then landed. The *Wellesley* opened a broadside fire, and in an hour's time had dismantled the breastwork of the fort, and the 40th were ordered to attack. But the enemy fired not another shot; the British flag was soon flying on the fort, and many of the garrison were captured endeavouring to escape. Next day the city of Karachi agreed to terms, and on the 4th February was occupied by the 40th Regiment. Thus Fyers saw his first action in an almost bloodless victory.

At Karachi the Brigadier remained, and it became the headquarters of the reserve. For over 18 months Fyers was at Karachi. In the meantime the army invading Afghanistan had entered Kandahar in April, 1839, stormed Ghazni in July, and placed Shah Shuja on the throne at Kabul in August. In the autumn the country seemed quiet, and Sir John Keane, the Commander-in-Chief in India, returned to India, handing over the command in Afghanistan to Sir Willoughby Cotton. Major-General Willshire also returned to India with the Bombay column, having stepped aside on his way to capture Kalat, in Baluchistan. The troops in Afghanistan were then dispersed about the country, those in Eastern Afghanistan under Brigadier Sale, and those in Western Afghanistan under Major-General W. Nott. The Commander-in-Chief, Sir Willoughby Cotton, and the headquarters staff were at Kabul with the British Envoy, Sir William MacNaghten, but Cotton was succeeded at the end of 1840 by General Elphinstone. During these events in Afghanistan the 40th Foot were eating their hearts out at Karachi, their life being varied by a bad outbreak of cholera in March, 1839, which carried off their colonel, Lieut-Colonel Powell, and another officer, and nearly a year later by the presentation of new colours to them by Lord Keane, after his return from Afghanistan.

At last however Fyers was to see some active service in Afghanistan. In the autumn of 1840 the 40th were ordered to Sakkar, and marched

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very leisurely there, experiencing much sickness on the way. Again, on the 2nd January, 1841, they formed part of a large force which marched from Sakkar to Quetta by Dadur and the Bolan Pass, arriving at Quetta in April. Here dysentery and fever played havoc with the troops, and Fyers suffered a good deal from the latter; but they remained there until October, when they were ordered to join General Nott at Kandahar. They marched through the Khojak in company with a battery of artillery, and arrived at Kandahar on 21st October, while Nott was away from Kandahar on the Derawat Expedition.

The country at this time was in a state of ferment from one end of it to the other. A growing bitterness with the prolonged stay of the hated foreigner was brought to a climax by the unwise decision of the Indian Government to reduce the stipends paid to the fierce tribes who held the defiles between Kabul and Peshawar; there was an insurrection in the Kohistan; then Sir Alexander Burnes, his brother, Lieut. C. Burnes, of the Bombay Army, and Lieut. William Broadbent, Bengal Engineers, were murdered on the 2nd November at Kabul, where fighting went on during the month that followed; after that came the murder of the British Envoy, Sir William MacNaghten, at Kabul, on the 23rd December; and finally, in January, 1842, the annihilation of the whole of the Kabul Brigade, on their way back to India, in the defiles of the Kurd Kabal and the Pari Dara, Dr. Bryden alone escaping to report the disaster to General Sale at Jalalabad. In the Kandahar command Nott took prompt measures. Some irregular cavalry mutinied on their way to Ghirisk and murdered their officer, and were immediately pursued and punished. Early in January, 1842, a large force of Afghans, under Sultar Jang, son of Shah Shuja, and Atta Muhammad, a Ghilzai chief, assembled near Kandahar, and Nott marched out to meet them with a force which included the 40th Regiment. This regiment, with the 2nd and 16th Regiments, formed the right column, under Colonel MacLaren, who was directed to advance to the Arghand-ab River, through the Baba Wali Pass; here a junction was effected with the left column. Before the columns crossed the river the enemy kept up a continuous fire. After crossing and wading through a swamp, up to their knees in mud, the line charged and defeated the enemy, who were greatly superior in numbers.

This was the first big action in which Fyers had taken part. General Nott now decided to camp his force outside Kandahar. Not until the 21st February, 1842, did Elphinstone's orders to evacuate Kandahar reach Nott, and then he refused to act upon them, as General Sale had done at Jalalabad. On the 7th March Nott again took the field, and drove the enemy across the Tarnak and over the Argand-ab, the 40th Regiment taking part in the fight. Successful sorties were made from Kandahar, in which Fyers took part, on the 25th and 26th, after which the garrison was left unmolested for some time. Reinforcements arrived in May, under Major-General

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England, who met with considerable resistance in coming up, and was assisted by a force sent out to see him through the Khojak.

Among a number of letters written by Lieut. Fyers to his family from India and Afghanistan the most interesting would have been those that dealt with the march from Kandahar to Kabul; but they were lost in transit, and I am only able to give extracts from a few letters written by him from Kandahar, and after leaving Kabul for India. The following refer to the earlier operations from Kandahar in 1842:—

Extracts from a letter from Lieut. W. A. Fyers, 40th Foot, to his parents, dated at "Candahar, 23rd April, 1842."

"In the last letter I wrote to you, which I believe never got over the Cojuk Pass, I had described to you how things were here and up at Cabool, and how I was getting on; but all that is material for you to know is that we passed through a very pleasant though cold winter with much satisfaction, and with improvement in health, having got into a comfortable range of barracks, where we all burnt good, cheerful fires, and we had plenty of exercise, but were constantly hearing reports of reverses to our people in the north, which have mostly all turned out to be too true.

"Few things that I recollect in the annals of English history can come up to the late tragic scenes near Cabool. The conduct and measures of the Envoy must have been in the last degree weak, and I must add foolish. The man himself may have been what you call a talented man, and a capital linguist, and otherwise accomplished, but he was most certainly too deficient in understanding to deal successfully with such a people as he was placed to have his eye on. But he is not the only specimen of that sort placed in positions of the greatest responsibility through the same error. . . .

"In my last I told you of a trip we were about to take after the enemy, who were harassing the whole country round and stopping our supplies, which you may believe we did not admire. General Nott therefore took out a large force of about 5,000 men. The first day we came suddenly on a body of the enemy's cavalry, who immediately made the dust fly in clouds from their horses' feet and disappeared, some of our cavalry and light guns after them; but they got off. The next day we came on them in large bodies about some strong villages. We formed into line and advanced on them, skirmishing with cavalry and light companies, before the fire of which they slowly retired; in this way we advanced, driving them before us for 3½ hours, some of the 12-lb. shot and shrapnel now and then knocking over horses and riders. They made their way over a deep channel of a river called the Turnau, when we dropped our pursuit and encamped. No tents except Mess tents, in which the officers slept together.

"Next day, as we were passing under a steep and rugged hill, a fellow took a shot at the General, riding at the head of the column. We then saw a number of them, among the rocks, and proceeded to turn them out. . . . We had several marches of this kind and skirmishes, but

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the main body would not stand; so having been out a week, we returned to Candahar.

"There we found that the enemy had made a forced march on the city, and had, two nights before our arrival, attempted to take it. They brought up to one of the gates after hours a number of ass-loads of firewood. The men with these were told that the gates were shut and could not be opened. They then asked for permission to let their loads of wood remain there until the morning, which was foolishly granted them. Some time afterwards the gate was found to be on fire and nearly demolished. The enemy, setting up a yell, then came on to the attack. They were however met with a deadly fire from the walls. Some of the enemy, well inflamed with opium, got in to the gate, but were either shot, bayoneted, or cut down. They continued to press on, but could make nothing of it, and our people, firing into their dense mass, killed and wounded great numbers of them. In about three hours they made the best of their way back again, having this time made rather a determined effort; two false attacks were made on other gates.

"Previously to our starting (on the week's scouring expedition) all those whose cast or character made them obnoxious were turned out of the city, and the arms of all within were seized and secured as far as was practicable. If this had not been done, we might have found ourselves in the wrong box.

"You will be fortunate if this letter ever reaches you. What is taking place at Quetta nobody here knows, except that the enemy, failing here, have taken possession of the Cojuk Pass, and have, we hear, been fighting with Colonel England, of the 41st, who, as far as we can ascertain, attacked their entrenched position and had a hard fight. Two officers were, we hear, killed on this occasion, both of whom I know. . . . This packet will be taken by a brigade, which is to start from this in two days for the Cojuk Pass, by way of a demonstration on Quetta, and to assist Colonel England in uniting the force he has with our own.

"The army from Bengal has by this time, I should think, arrived at Cabool. The fate of Ghuznee is still very uncertain, whether it still holds out or not. There is only one regiment there and a small body of horse. I have my fears for its safety, though the arrival of General Pollock's Army at Cabool may be the saving of it.

"Temporizing with a people such as these Affghans has been the cause of all this reverse and difficulty.

"If the British Government intend still holding this country, they must do so with a gauntlet of mail and with the axe hanging over the head of any man likely to influence the rest. In short, we must treat them as our fathers would have treated such a set, and not in the milk-and-water style that has up to this time been the fashion.

"Young Gardner, who, you mentioned to me in your last, was on his way here to join the 38th (N.I.), has been, I find, some time waiting at Quetta for the marching of the force which is to join us. . . ."

On the 17th May, 1842, he again writes to his parents from Kandahar, and the following is an extract referring to the proposed relief of Kalat-i-Ghilzai :—

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"I am writing this to you in all the bustle of a move, as we start for Kelat-i-Gilzie to-morrow morning. This strong fort is garrisoned by a regiment of Native infantry and some artillery, and is now invested by an army of Affghans, stated at 4, 5, and 6 thousand strong. We march about 6,000; it is said the enemy (Ghilzais) are resolved to give us fight, but this we always hear; they are, though, the most warlike of the tribes here, and there is some chance of their giving us an opportunity of wreaking our wrath. It is supposed that we only go a few marches beyond Kelat-i-Gilzhie, and then return again. We may, though, have to go to Ghuznee, which is now in possession of the enemy, and rattle them out of it, if they wait for us. I am very anxious to hear what the determination of the British Government is regarding this country. I am strongly for maintaining our possession of Candahar and keeping the road open by military posts; we should hold, I think, some place in Central Asia to maintain our interests, and merely as an advanced post. . . . It should be made a military colony, being for miles around capable of sustaining a large population. . . .

"It was with great pleasure I met young Herbert Gardner.* . . . He seems to like his regiment; they belong to the same brigade as ourselves, and are going with us. We (the 40th) will go nearly 600 into the field, all healthy and in capital blow. Kelat-i-Gilzhie is very elevated, so that we expect to have a cool march. . . . The enemy's force are chiefly cavalry, and as we have a very small number of that arm, they of course can move round us, and go five times the distance we can in one day. We want one regiment of Light Dragoons; they would astonish them. . . ."

Lord Ellenborough, who had succeeded Lord Auckland as Governor-General of India, was bent on a policy of withdrawal, but General Nott was eager to advance on Kabul and join hands with General Pollock, who was pressing to be allowed to advance to the relief of Sale at Jalalabad. In the meantime Nott sent Colonel Wymer with a brigade, including the 40th Regiment, on 19th May to relieve Kalat-i-Ghilzai, of which the small garrison had so nobly held their ground during the winter. They arrived before Kalat-i-Ghilzai and successfully accomplished their task, and destroyed the fort, returning to Kandahar on the 10th June.

Extracts from a letter to his parents from Lieut. Fyers, dated "10th June, 1842, Candahar Cantonments."

"You will see by the place I write this from that we have returned from the trip I mentioned in my last. We were then going immediately to Kelat-i-Ghilzie, and we supposed on to Ghuznee. Altogether it turned out pleasing enough, as it was by no means so very hot, and the marches were generally short and early over. The valley of the Turnau, through which the road passes, was then one unbroken field of wheat, from where we came on it to Kelat, about 70 miles, and is the same I fancy in its whole extent. Our force consisted of about 3,500 men of all arms, and we were as often as not pitched among the growing wheat—camels, men,

* His cousin (see *ante*, under Gardner).

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horses, etc., making, as you may suppose, pretty havoc among it. We did not see a single inhabitant the whole way up, so there was no doubt of their feelings towards us; they did not oppose our progress though by a single shot (strong as the country was).

"On our arrival at Kelat-i-Ghilzie we found that the body of the enemy who had been investing it for months, hearing of the departure of the force from Candahar, had had the boldness to make a very determined attack on the fort, but had been beaten back with great slaughter; two pits had been filled with the dead the enemy were unable to carry off.

"The garrison were in the finest health, though they had for some time been reduced in their rations; some Bengal artillerymen too, who had not had a drop of grog for months, were looking as hearty as possible.

"The fort is on a hill about ¾ mile in circumference, of no great height. On its summit there is a mound which rises some height above the rest, and from which issue a number of springs, which, uniting, form a beautiful little stream of water, much more than sufficient to supply all the wants of a garrison. Very nice barracks had been built for officers and men, and it seemed altogether to be a place that, if supplied with necessary munitions of all kinds, might have set Affghanistan at defiance for a long time. I believe the enemy acknowledge themselves to having 500 killed and wounded, which may be reckoned at 400 killed, for very few recover who are in any way badly hit; they have a prejudice that a wound received from us must prove mortal.

"We remained at Kelat some days in great uncertainty as to whether we were to go on, or to retrace our steps. We believed the latter was our destination as no sooner had we arrived than the garrison was ordered out, and working parties from every regiment were in orders for the purpose of destroying the fortifications, etc. This took up several days, and no one knew for certain which way we should continue our march until we found ourselves in column looking to the west; then, thought I, the die is cast, they are resolved to make the most of a bad business by not squandering any more money on the country, and are going to quit. . . ."

Extract from a letter from Lieut. W. A. Fyers to his brother, Lieut. H. Fyers, R.A., dated "August 2nd, 1842, Candahar."

". . . I want to let you all know that we are going on towards Ghuznee with a large proportion of the force now here. What we are really going to be about is still a secret, but it is thought not improbable that we will have the retaking of Ghuznee at least, and that eventually we are to go by a road, which leads through the Soliman Range, down to a place on the Indus called Dara-Ismael-Khan; there it is supposed we are to be an army of observation on the conduct of our uncertain allies, the Seiks. . . ."

The persistence of Generals Nott and Pollock at length induced the Governor-General to give way, and Nott was permitted to adopt "the line of retirement by Ghazni and Kabul." On the 30th July Nott received his orders; part of the force, including the sick, was to leave the country by Quetta and the Bolan, and the main body, composed of the *best troops*, was to *retire* to India by way of Ghazni

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and Kabul. Among the best troops was the gallant 40th Regiment. On the 9th August General England moved south and General Nott north. The latter met with no opposition until he reached Kula Azim, a march beyond Mukur, where on the 28th August a cavalry affair occurred, and on the 30th, near Ghoain, he encountered Shamsh-ud-din Khan, the Afghan commander, with a force of 12,000 men, who came boldly on to the attack, but was defeated with loss of guns, ammunition, and tents. The light company of the 40th brought in the captured guns. Shamsh-ud-din then fell back on Ghazni.

Ghazni was reached on the 5th September. Siege works were begun the same night. On the following morning it was found that the garrison had fled. The walls of the citadel were destroyed and the gateways demolished. The famous sandal-wood gates of Samnath were removed from the tomb of Sultan Mahmud, and carried off under escort of a company of the 40th, in accordance with the orders of the Governor-General. Resuming the march to Kabul, resistance was again encountered at Beni-badam on the 14th, when the 40th took possession of the heights, and at Maidan on the 15th, when the forts were destroyed. On the 17th September Nott encamped his troops near Kabul, where he found Generals Pollock and Sale had already arrived.

After resting for nearly a month at Kabul, the 40th Regiment set out on their return to India through the Khurd Kabul and Khaibar Passes. At Tezin on the 15th October the rear guard was attacked and was hard pressed; a wing of the 40th Regiment was sent to their assistance, and rushed the position of the enemy and drove them off.

On the 19th a subaltern of the regiment was wounded in a rear-guard action and a number of men killed. At Ali Masjid the 40th was on rear-guard duty, and was much molested by the Khaibaris on the 4th November. At Fathgar the enemy made a final attack, and again the 40th were prominent in driving them off.

Extracts from a letter from Lieut. W. A. Fyers to his parents, dated from "Camp near Peshawur, 8th November, 1842."

"I am certain of the pleasure it will give you when you see by the place this is dated from that the fatigues and troubles of our Affghan War are over. I have written to you from both Ghuznee and Cabool, but I fear you never can get those letters. . . .

"As to our campaign, I have never spent a pleasanter time, and from the day we started from Candahar have been as happy as you could wish me to be. Nott, by his decisive move from thence, obliged everybody to be on the alert, and the consequence has been unbroken success.

"The destruction of Ghuznee was most complete; that of Cabool very partial, and badly brought about through the want of energy of the other commander. If our General had got there first he would have given the people a few days' warning, and destroyed both town and defences in a way that would have given a lesson to such faithless wretches, and their

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children after them.* I do not advocate cruelty, but ought not the crimes of an individual nation to be punished and have a mark put on it as much as when only individuals of a nation are concerned? . . .

"I had no idea that the passes between this and Cabool were such places as they are. . . . They are tremendous, and the getting through them by force of arms is certainly what could hardly be expected if the inhabitants were worth their salt. . . . A day or two ago we (the 40th) were on baggage guard, or rather rear guard, from 6 in the morning until 6 the next—24 hours, but as to our defending the baggage, it was impossible, for there was a string of camels the whole way into the next camp—15 miles; the consequence was a good deal was lost, as you may suppose. We have had a number of scrimmages since entering the passes, in which we have not escaped scot free. These you will see by the papers. For my part, thanks to the Almighty, I have not had as much as a scratch . . . and have enjoyed very good health.

"It is thought we shall be at Ferozepoor about the 25th December. We shall, I daresay, be very gay. . . ."

On the 22nd December Nott's force reached Firozpur, and next day was received with great honour by the Governor-General, the Commander-in-Chief and their Staffs, and a brilliant assembly. Already Nott had received at Gandamak, on his way down from Kabul, a copy of the General Order of the 21st September, acknowledging the splendid services of the force he had commanded.

The part that Fyers's regiment had taken in the bold, successful march of Nott's force from Kandahar to Kabul, and thence by the Khaibar route to Peshawar, might well be deemed sufficient to initiate the young subaltern into the art of war, and as he was a keen soldier, his experiences in Afghanistan, as will be seen by his later achievements, were not lost on him. For his services in the campaign Fyers received the Afghan Medal, with clasps for Kandahar, Ghazni, and Kabul.

In the spring of 1843 Fyers returned to England, and from 1845 to 1847 was employed on recruiting service at Tonbridge, Kent. While there he had the misfortune to lose his father, the veteran Major-General Peter Fyers, who died in May, 1846, aged 77 years. Fyers was promoted to a company, after 12½ years' service, on 7th May, 1847. Three years later he exchanged into the 4th Foot, and on 8th July, 1851, he again exchanged into the 1st Battalion of the Rifle Brigade, then stationed at Dover. When the service companies of this battalion were sent to South Africa to take part in the Kaffir War, Capt. Fyers's company was moved to Walmer. There, on the morning of the 14th September, 1852, the great Duke of Wellington died at Walmer Castle. Among the Duke's many distinctions he numbered the Colonelcy-in-Chief of the Rifle Brigade, and used frequently, when at Walmer, to visit the Depôt Barrack Square of the Rifle

* Stocqueler, the biographer of Nott, says that Nott would have destroyed the Bala Hissar, but would have spared the city.

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Brigade with his grandchildren. Capt. Fyers had the honour of commanding the Guard of Honour at the Castle while the Duke's body remained there until the 10th of November, and also of taking part in the State funeral procession from Chelsea Hospital, where it had lain in state, to St. Paul's Cathedral in London on the 18th November.

On the outbreak of the Crimean War, Capt. Fyers embarked at Portsmouth at the beginning of March, 1854, with a portion of the 2nd Battalion of the Rifle Brigade, in the transport *Vulcan* for Malta. On disembarking there on the 11th March, he stayed at the Palace, Valetta, with his cousin and uncle by marriage, His Excellency Colonel Sir William Reid, who was at the time Governor of Malta. Several of the chiefs of the allied armies were arriving at Malta during his stay there, and among others he had the opportunity of making friends with General Canrobert. Fyers sailed again at the end of the month in the transport *Golden Fleece*, with Major-General Sir George Brown, commanding the Light Division, for Gallipoli. During this voyage he must have made the acquaintance of a young fellow passenger in the Royal Engineers, who afterwards became famous, the late Lieut.-General Sir Gerald Graham, V.C., G.C.B., who sailed from Malta as a subaltern with two companies of Sappers and Miners in the same ship, while another fellow passenger, then unknown, but destined to distinguish himself in quite another line, was the *Times* correspondent, the late Sir William Howard Russell.

On arrival at Gallipoli, the 2nd Battalion of the Rifle Brigade was employed in throwing up the entrenchments across the isthmus between the Gulf of Saros and the Sea of Marmora, called the Lines of Boulair. Before moving to Constantinople, the opportunity was taken of showing off the British troops at a review before the French generals. In describing this review in a letter to a relative Fyers mentions that, the weather being very hot, large numbers of men fell out, until the ground had the appearance of the scene of a recent engagement. He throws the blame partly on the heavy loads which the men had to carry and partly on the high collar and stock "that our martinets are so fond of." Hereby hangs a tale. An extract from this letter was sent indiscreetly by his correspondent to the *Times* newspaper, and it is needless to say that when a copy of the paper in due course reached Sir George Brown in the Crimea, the fat was in the fire. Sir George was one of the old school who delighted in pipe clay, and could express himself in strong language when he was irritated, so that Capt. Fyers had a very unpleasant interview with the old General in his tent one morning after the arrival of the mail.

After a short rest at Scutari, the 2nd Battalion of the Rifle Brigade moved to Varna, and then to Aladyn and Devna. There cholera broke out among the troops, and it was moved to Monastir. At last, in the early days of September, came the welcome news that the army was to go to the Crimea. Fyers embarked with his battalion at Varna

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in eight transports, his own company going in the *Mary Anne*, and landed on the shore of Eupatoria Bay on the 14th September.

Some idea of the share taken by Fyers and his men in the Battle of the Alma may be gathered from Kinglake's elaborate account of the battle and from W. H. Russell's letters to the *Times* newspaper, but the following extracts from a letter written by himself to his family at home give a more particular insight :—

"CAMP ON THE HEIGHTS OF ALMA,
September 22nd, 1854.

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"You will see by the despatches how greatly our division has suffered: to me that great and, in many instances, personal loss is the more painful that it was evident to me, as to most others, that it resulted very much from a deficiency in the leading of some of those commanding regiments, who allowed their corps to close too much upon one another, until at last they became quite clubbed, and the grape and round shot then told with fearful effect.

"My company was on the extreme left in skirmishing order. The enemy's rifle balls and shot were coming fast as we approached the river and the gardens on both sides of it. I gave the word, and down we went on it, secured a wall, and fired away. I then got possession of a road through the vineyards, led my men through it, seized different strong points in turn, and came on the river. Here I found a good ford, and at once crossed. Vineyards and ruined houses were before me. I took a careful survey and decided on making a dash on these. They were taken. I had a high bank then in front, with a wall running along half-way up. This was good cover, and I made for it, to wait for further orders and for support.

"Errol's company had been my support, and now came up and lined the bank. Shortly after Major Norcott came up and took command of the two (companies) and led us further on. We then crowned the bank, and kept up a hot fire on guns and skirmishing riflemen. Here the grape, canister, and rifle bullets flew about us thick as hail. I lay at full length behind a stone about 16" high, now and then taking a shot with my little rifle at the artillery, but it was too far for it. An entrenchment with guns was about 500 yards in advance. We made for this in two rushes. It was a dreadful trial to my strength and wind, and midway I fell down quite spent with exertion. Here I got a little shelter by the mere inequality of the ground, rifle balls falling fast around. I took a minute or two breathing time, and then pelted on my heavy limbs as well as I could to the entrenchment.

"My company was by this time much broken, and their strength had been much tasked, for we had been kept too long unsupported by infantry. Those who were there did good service, but at last we got mixed with the 23rd, 19th, and some others who were there in no order at all, completely clubbed. A cry was raised by some officers that we were firing on the French, and the bugle sounded the 'Cease Firing.' This the men did not understand, for the batteries were raking them with grape; so with one consent they turned round and in a quiet walk

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retreated towards the cover they had left. It was here and then that the frightful losses occurred, but half-way we were met by the 1st Division coming on in line. They let us pass on through, and they then took their turn well and successfully, and very soon the enemy retreated.

"The action commenced on the right by the French, but we had the brunt of it. The Russians had a hundred guns in the field; some of them, which the Light Division took, 32-lb. brass guns, beautiful pieces; these were the guns that dealt such volleys of shot on us. The Russians had all the distances staked. Their rifle is a beautiful arm, superior, I think, to ours, and made at Liège, in Belgium. The sight is far superior to ours, and marked for 1,200 yards; however, the Minie must have done good service, for great numbers of the Russians were shot in the head.

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"I think I may take some credit that my loss in the late engagement was so small, for I worked like a horse to make the men get into every shelter that offered. My loss was one sergeant and one private killed, three privates and one bugler wounded. I will not say that all came to the scratch as they ought to have done, but very many are very young officers and soldiers, and it was a severe trial for the first time. They will pay more attention to me another time.

o o o o o

"W.A.F."

Sir William Cope, in his *History of the Rifle Brigade*, gives the following account :—

"Descending the slopes of the right bank of the Alma, Norcott's riflemen entered the vineyards, and at once were exposed to the fire of the Russian artillery, and became engaged with their light troops. Fyers's company was extended on the extreme left, with Lord Errol's company in support. The riflemen, inclining to the left to avoid the burning village of Búrliúk, which, as we have seen, had been fired by the Russians, forded the river and, ascending the other bank and passing through the vineyards, halted at a wall—a low wall which separated the cultivated ground from the slope beyond. Here Norcott moved up and extended Errol's company on the right of Fyers, and then, or soon after, he advanced, and inclining to the right, on observing that Codrington's Brigade has disarranged or lost its formation, and was threatened by a Russian column, he poured such a searching fire from his line of skirmishers that the enemy were checked, and hindered from taking full advantage of the want of regular formation of Codrington's Brigade."

Major (afterwards General Sir) William Norcott wrote that the conduct of Capt. Fyers at the Alma was conspicuous for coolness and gallantry; "the first man in the infested vineyard, across the river, and swarming the opposite bank under a fire that called for leading."

Lord Raglan, in his despatch, says that the capture of the Great Redoubt was materially aided by the advance of four companies of the Rifle Brigade, under Major Norcott.

Cope writes as follows of the part taken by the 2nd Battalion in the flank march to Balaklava, under Lord Cardigan :—

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"On this day (September 26th) the 2nd Battalion led the advance on Balaklava. The approach was by a narrow gorge, with high, bare hills on each side. Colonel Lawrence detached his majors, Norcott to the right, Bradford (Major-General W. H. Bradford) to the left, while he himself, with two companies, kept the centre. Thus they approached Balaklava, throwing out skirmishers. No opposition was offered till they had advanced some distance, when some musketry fire was opened; but this was only from a few men on the heights, who were soon driven in; and the advance continued. A staff officer then reported to Lord Raglan that the road was clear, and he rode forward, and was just entering the gorge, when Lawrence observed to him that he still saw some of the enemy on the hills, and asked permission to send a company in advance. This was granted, and Fyers's company was taken by Norcott towards the town.

"On their approaching it, and the battalion appearing on the heights, a few harmless shots were fired from the old Genoese fort, and soon after, on their advancing nearer, a white flag was hoisted. Fyers, who mistrusted the sincerity of the Governor, directed his subaltern to halt with one subdivision, whilst he, with the other, advanced by a narrow road engineered between the high ground and the sea. On Fyers' men entering the fort, the Governor left it by another side and, meeting Egerton and Ross, surrendered, handing his sword to the former. Then Fyers taking his company into the town, a baker, evidently in great terror, came out of his house and, notwithstanding the early hour of the morning, produced a roast turkey, which he offered him, and a great number of loaves. These Fyers desired him to break in two and to give half to each man. So that all the men of his company had a good meal.

"The battalion subsequently occupied Balaklava, posting sentries for the protection of the inhabitants, and at night bivouacked among beautiful vineyards outside the town."

Capt. Fyers, writing on the 29th September about this same flank march, says :—

"I came on an upset wagon (Russian), with a horse on the ground kicking; further on a great many wagons laden, but horseless. In short, it turned out that those in advance had come up with the baggage guard of a considerable Russian force which was leaving Sebastopol: it was, I understood, purely accidental however; the Horse Artillery had fired a few rounds and the cavalry had charged, and the result was the most utter confusion, everything left higgledy-piggledy on the road. A number of valuable things were secured by the men, and some cavalry officers in front had apparently secured some good things, fur cloaks, military orders, plate, money, etc. Our men got a few things, and I purchased a curious ring from one of them."

During the month of October, Capt. Fyers, with his company, was employed in the trenches before Sebastopol, afterwards so memorable, to cover the working parties. "On the 14th October," says Cope, "Fyers was with his company in the 5-gun battery when he observed a column of Russian infantry advancing. Taking a rifle from one of the men, he put the sight at what he considered their distance and fired, carefully watching the effect of the shot. When

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he perceived that it struck the ground a little in front of the column, he ordered his men to fix their sights for 750 yards and 'give it them.' They had not been long firing when he found that he was under fire from the rear.

"Some of the Russians had moved up the ravine towards a house which was occupied by a picquet of another regiment under a sergeant, which had retreated on their approach, and the Russians, having taken possession of the house, were firing on Fyers's party. He therefore sallied with his company out of the battery and drove the Russians back, not before they had eaten the dinners of the former occupants of the picquet-house and carried off their coats and blankets. Most of these they dropped on their way back, as they probably impeded their retreat, pressed as they were by Fyers and his party. . . . In this affair two riflemen were wounded. Fyers took a sergeant and some men prisoners, of whom three were wounded; several others were carried off by their companions, and many were killed.

"On the alarm, Sir de Lacy Evans had moved up two regiments and some of the 1st Division, and the rest of the 2nd Battalion (of the Rifle Brigade) were brought up and halted in rear of Gordon's battery, and some guns were ordered up; but before these troops came into action Fyers had repulsed and effectually disposed of the Russian attack."

Admiral Sir Edmund Lyons, having expressed a wish that his Marines, who were holding a position on the heights above Balaklava, might have a share in the work in the trenches, the important position on the heights was taken by four companies of the 2nd Battalion of the Rifle Brigade. On November 4th the companies commanded by Capts. the Earl of Errol, Hammond, Fyers, and Colville, under Major Bradford, Major Norcott being sick, proceeded to their new post.

On the 14th of this month Fyers found himself a helpless spectator of the havoc caused to the shipping in Balaklava Harbour by the terrible gale of that day. He writes :—

"It was with the greatest difficulty I got along, every now and then obliged to throw myself flat on the ground, and sometimes hurled with violence down the hill, which is very steep. At last, after a great struggle, I got among the ruins of the old castle and gained a rock overhanging the sea at this point. I lay flat on my face with a firm hold of the rock, and from this point I saw five transports go down; first by being driven on the rocks, and then filling and sinking. The *Prince*, just arrived from England with all the warm clothing, etc., was one of them."

However the staves of broken casks thrown up among the wreckage proved very useful to him for roofing the hut which he had constructed to shelter him on the wind-swept hill.

When the spring came, after that terrible winter of hardship and privation, Fyers was again in the trenches, where he continued to do

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duty until the fall of Sebastopol. At the unsuccessful attack on the Great Redan on the 18th June, 1855, Fyers acted as second in command to Colonel Macdonnell.

Cope relates an incident that occurred on the 3rd July :—

"Capt. Fyers was coming off picquet in the advanced works with about 400 men. They were retiring by a zigzag which by some oversight of the Engineers was directly enfiladed by a Russian gun. As soon as the men were well in the boyau a round shot was fired, which, bounding along, knocked down 13 men, of whom eight were killed, or died of their wounds. The wounded were removed by Fyers, Colour-Sergt. Kemp, and some soldiers of another regiment, who came to their assistance. The rest of the men turned into another zigzag not exposed to this fire. The ball, after this destructive course, ran along the boyau and stopped against the bank of the parallel a dead ball."

It was in this month that Colonel Williams, the gallant defender of Kars and Chief British Commissioner with the Turkish Army in Asia Minor (afterwards General Sir William Fenwick Williams, Bart., of Kars, G.C.B., Royal Artillery), wrote to Fyers the following letter :—

"KARS,

"MY DEAR SIR,' "*July 14th*, 1855.

"I must be candid with you. I did receive your first letter, but I am up day and night, being closely invested by a large Russian army under General Moravioff, and in hourly expectation of being assailed by him. I have begged Lord Clarendon, *as a personal favour*, to send you to serve with me. The letter goes off to-day. Send these lines to Sir W. Reid, for whom and Lady Reid I have and shall always retain the highest regard and esteem; that link, added to my having known your parents from my earliest days, is quite sufficient to bind us together in this work of war.

"Believe me,

"Very truly yours,

"W. F. WILLIAMS."

It would seem that Capt. Fyers must have written to Colonel Williams to ask him to apply for his services on his Staff, and getting no reply had written again, and had probably asked his uncle, Sir William Reid, to write also on his behalf. Nothing came of it.

When the Siege of Sebastopol was about to finish came Fyers's great opportunity. Writing to his mother on September 7th, he says :—"I have just time to tell you that I am placed in command of the covering party, that is, those who go first, in an attack on the Redan. . . . I have not volunteered this duty. General Codrington called me out from parade and told me he had selected me for it." He certainly never expected to come out of it alive.

Cope says :—"On September 8th, when the assault was to take place, one half of the 1st Battalion being in the trenches under Colonel Norcott, the remainder, consisting of about 280 men, under Lieut.-Colonel Somerset, moved out of camp at 11 a.m. and took up a position in reserve on the Woronzow road. The 2nd Battalion

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furnished a covering party for the assault of the Redan, consisting of 100 men,* under the command of Capt. Fyers, who were to cover the advance of the ladder party and to keep down the fire from the parapet; a party also of 100 men, under Capt. Balfour, occupied some broken ground and a Russian rifle pit in front of and to the right of our most advanced works, who were also directed to keep down the fire from the parapet. With the same object, two parties of 50 men each, under Lieuts. Baillie and Playne, were stationed one in the fifth parallel and one in the Woronzow road. The remainder of the battalion, about 230 men, under the command of Lieut.-Colonel Macdonnell, took part in the general attack.

"These men had to advance 150 yards, exposed to a most terrible fire in front and flank. This attack, most gallantly carried out, was not entirely successful, though, as is well known, the operations of the day led to the abandonment of the works by the Russians and the fall of the place."

Fyers described his share in the assault as follows :—

"Sept. 11th. The grand event has come off, and long ere you get this you will know I have been again most mercifully spared. . . . As to those I had the command of, they behaved very well indeed and carried out their orders as well as they possibly could. I had 100 men, with sergeants, and 2 subaltern officers, Lieuts. Moore and Ryder of our own regiment, and 100 men, with their officers, of the 3rd (The Buffs). This was the covering party, to go before and protect the advance of the ladder party. After the French had made their rush at the Malikoff and got into it so well, the signal was made from thence for our advance, and repeated from one of our batteries, on which we jumped over the parapet in open order and advanced with all the rapidity we could, followed immediately by the ladders and storming party. I had detailed off two parties, each under an officer, to fire on the embrasures which flanked the angle of the Redan, in order to keep down their fire. On we went till we came within a few yards of the ditch, and then got what cover could be found, commencing a fire at once on the parapets and embrasures, while the ladders were brought up very well and got down into the ditch. The 97th and 90th, leading the stormers, pushed very well up to the works of the Redan, crossed the ditch, but when so far, whether it was from fear of mines inside, or whatever it may have been, they would not go further, and all that the officers could do was unavailing to get them further.

"This was the deuce for those lying outside, who expected that the gunners (Russian) would be soon shot down or bayoneted, and consequently the grape shot and other pleasing missiles continued to rattle and hiss, on every side laying men low. This sort of thing went on, those on the earthwork of the Redan refusing to go forward, and others coming on, expecting them to make way for them. The enemy's shot swept our columns as they endeavoured to cross over the 250 yards of

* This covering party numbered 200, half being Rifles and half Buffs, all under Fyers's command.

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ground between our trench and the Redan. . . . When there was no longer any doubt of our failure, and we had again sought our own trenches, I found that I had lost very severely, but as yet I do not know the full account. An officer and 4 sergeants killed, and 1 officer contused, and a large proportion of men (riflemen) wounded."

The special correspondent of the *Times* wrote to his journal :—

"Of the commanders of parties, only Acting Brigadier-General Windham, Capt. Fyers, Capt. Lewes, and Capt. Maude got untouched into the Redan. . . .

"The riflemen advanced admirably, but from their position they could not do much to reduce the fire of the guns on the flanks and below the re-entering angles. The bravery and coolness of that experienced, deserving, and much neglected officer, Capt. Fyers, were never more brilliantly displayed or urgently called for, and here let me ask how is it that an officer like Capt. Fyers, with 21 years' full service, who went through the campaign of Candahar and Afghanistan in 1841 and 1842, and who was present in five actions, who was at Khelat, and was with his regiment throughout Nott's campaign, who was conspicuous for his gallantry at the Alma, and whose conduct in the trenches has been beyond all praise, is exposed to the pain and mortification of seeing young men, who were scarcely born when he was a soldier, raised above his head because they have had the good fortune to look at a battle from a distance or to ride in the rear of some cautious General! I know nothing of Capt. Fyers's past services except through Hart's *Army List*."

From October 1st till his departure for home on the 5th December, 1855, Fyers was in command of the Guard of Honour to the Commander-in-Chief, consisting of 6 officers and 200 men. By this time he was one of only 11 officers remaining with the Light Division who had originally landed with it in September, 1854. He had entered on this campaign when he was 39 years of age and had 20 years' service, but was still a Captain. Such was the fate in those days of an officer who, although he had seen more service than any other officer in his battalion and had few equals as a leader of light infantry, was lacking in money and in influence in high places. But the Crimean Campaign was the dawning of a new era, and rewards were lavishly distributed, too lavishly it was thought by many who remembered that many a veteran who had served in the junior ranks under the Great Duke in the bloody battles and sieges of the Peninsula War had not even a bit of red riband to show until more than 30 years after it was all over, and then how few were left alive to be grateful for this tardy recognition of their services.

For his services in the Crimean Campaign Fyers was mentioned in despatches, received the war medal, with clasps for Alma and Sebastopol, the 5th Class of the Legion of Honour, the 5th Class of the Medjidie, and the Turkish Medal; he was also promoted to be Brevet Major on the 2nd November, 1855, and Brevet Lieutenant-Colonel on the 26th December, 1856.

(*To be continued*).

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TRANSCRIPTS.

THE ENGINEER SCHOOL AT WASHINGTON.

THE following General Order, issued by the American War Department at Washington in October last, gives the regulations governing the Engineer School at Washington, and is reprinted, as it is likely to prove of interest to readers of the *R.E. Journal.*

General Orders, No. 136, War Department, August 16th, 1905, is hereby rescinded, and the following regulations governing the Engineer School at Washington Barracks, District of Columbia, are announced :—

1. The object of the school is to prepare the junior officers of the Corps of Engineers for the active duties of their arm and corps; to make researches in such branches of science as relate to the duties of the Corps of Engineers; to disseminate information so obtained; to make such experiments and recommendations and to give such instruction as may be necessary for the civil engineering work of the Army.

2. The Engineer School at Washington Barracks is under the supervision and control of the Chief of Engineers. It consists of a commandant, a secretary, and such directors, instructors, student officers, and troops as may be assigned to it for duty or instruction by orders from the War Department. The Chief of Engineers may correspond directly with the commandant on questions of a technical character which do not involve matters of command, discipline, or administration, and do not relate to the status or interests of individuals.

THE COMMANDANT OF THE SCHOOL.

3. The general administration of the school is entrusted to the commandant. In case of the absence or disability of the commandant, the senior engineer officer present for duty at Washington Barracks will act in his place in all matters pertaining to the school.

4. The commandant will make application to the Adjutant-General of the Army for such articles as may be required for the school, and will direct the expenditure of such authorized quantities of material as may be necessary.

5. The commandant will submit to the Adjutant-General of the Army, on or before August 31st of each year, a report of the operations of the school for the year ending on the 30th of June preceding, with such suggestions and recommendations as he may deem desirable for the interests of the school. He will also submit to the Adjutant-General, on June 30th of each year, a detailed programme of instruction to be carried out at the school during the ensuing school year. This programme, when approved by the Secretary of War, with such modifications as may be deemed necessary, will be returned to the commandant for the information and guidance of the officers on duty at the school.

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THE SECRETARY.

6. The secretary of the school will be the custodian of the records, books, and property of the school, and the recorder of the school board. He will conduct the correspondence of the school and promulgate the orders of the commandant.

7. The school library will be maintained separate and apart from the post library. In case of loss or damage to any book, periodical, map, or other property belonging to the school, the person responsible for such loss or damage will make the same good by the payment of the actual cost of the article or the cost of repairs. This amount will be assessed by the secretary of the school, whose action, when approved by the commandant, will be final.

DIRECTORS AND INSTRUCTORS.

8. When practicable the directors and instructors will be senior in rank to the student officers, but whether senior or junior the directors and instructors, while in the execution of their duty, will be accorded the respect due to their position.

9. The directors, instructors, and student officers will be exempt from all ordinary staff duties and garrison routine, from attendance at the garrison school for officers, from court-martial duty, from such drills and ceremonies as are not included in the course of instruction, and in general from all duties which would interfere with the performance of their functions in the school; *provided*, that in case of lack of sufficient officers for the proper performance of garrison and post duty the commandant may assign school officers to such duty.

THE SCHOOL BOARD.

10. The school board, consisting of the commandant, the directors, and the instructors, will arrange the programme of instruction as to subjects, textbooks, and allotment of time; prescribe the character and scope of the examinations and re-examinations, and have final determination of all questions of proficiency of students; *provided*, that no action of the board which changes the regulations of the school or the course of instruction shall be final until approved by the Secretary of War. The school board will meet at such times as the commandant may deem advisable.

11. The deliberations of the school board and its decisions until duly published will be confidential.

THE COURSE OF INSTRUCTION.

12. The course at the school will begin September 1st of each year, and will be concluded about September 30th of the following year. Sessions of the school will be held daily, except Saturdays, Sundays, holidays, and the period from December 23rd to January 4th, both inclusive. Practical work and practice will be combined with theoretical work in all subjects in which it can be advantageously done, and will include the use and operation of instruments, apparatus, and machines; field astronomy; photography and map reproduction; geodetic and hydrographic surveying, and garrison and field duties with engineer troops.

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13. The course of instruction will be divided into three departments, as follows: —

(*a*). Military engineering.
(*b*). Civil engineering.
(*c*). Electrical and mechanical engineering.

The school board may transfer from one department to another such of the subjects hereinafter mentioned as it may deem desirable for the equalization of duties of directors and instructors.

14. In the different departments instruction will be given in the following subjects:—

Department of Military Engineering.

Seacoast defences, including land defence.
Ordnance, armour, and explosives.
War ships and sea power.
Photography and map reproduction.

Department of Civil Engineering.

Surveying, geodetic and hydrographic.
Field astronomy.
Cements and mortars.
Concrete and masonry.
Foundations.
Roofs and bridges.
Building construction.
Heating and ventilation.
Water supply.
Sewage disposal.
River and harbour improvement.
Lighthouse construction.
Construction plant.
Contracts, specifications, estimates, and accounts.

Department of Electrical and Mechanical Engineering

Direct current machinery and storage batteries.
Alternating current machinery.
Electric power transmission.
Electric lighting and searchlights.
Fire control apparatus.
Steam power electric machinery.
Hydro-electric power machinery.
Internal combustion engines.
Electric power plant design.

15. In connection with the prescribed course of instruction in the several departments, visits will be made to points where important engineering works are in progress, when such visits are approved by the Chief of Engineers and authorized by the Secretary of War.

Examinations.

16. Subject to the following limitations, examinations will be held under such rules as the school board may prescribe, as soon as practicable after the final review in each subject.

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17. An officer declared deficient in any subject may apply in writing for re-examination in that subject, but such application must be made immediately after the announcement of the result of the original examination. A re-examination will be of such a character as may be determined by the school board, and will be held with as little delay as practicable.

18. Officers who have been unable to complete the entire course will receive certificates of proficiency signed by the commandant in such subjects as shall have been satisfactorily completed.

19. A student officer, who by reason of sickness or other unavoidable cause has been absent from an examination, or has been unable to complete entirely any course with his class, may be permitted, in the discretion of the school board, to complete the said course and be authorized to take the necessary examination before or within a reasonable time after the graduation of his class.

DISCIPLINE.

20. The school will be governed by the rules of discipline prescribed for military posts, and by special regulations formulated by the school board and approved by the Secretary of War.

GRADUATION.

21. A student officer who successfully completes the entire course of instruction will receive a diploma setting forth his proficiency, and his name will thereafter be borne upon the Army Register as a graduate of the Engineer School at Washington Barracks. Diplomas will be signed by all members of the school board. The fact of graduation of each officer will be reported to the Adjutant-General of the Army as soon as practicable thereafter.

22. Graduates of the school will be exempt from professional examination for promotion in all subjects covered by their diplomas for a period of two years after graduation. Officers not graduates, holding certificates of proficiency in any subjects embraced in the course, will be similarly exempt from such examination in the subjects covered by their certificates of proficiency for a period of two years from the date of such certificates.

By order of the Secretary of War,

W. W. WOTHERSPOON,

Brigadier-General, Acting Chief of Staff.

Official:

HENRY P. MCCAIN, *Adjutant-General.*

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THE FINAL STRUGGLE FOR 203-METRE HILL AT PORT ARTHUR.

Translation of an article by Staff-Capt. Kostiushko in the March, April, and May numbers of the *Eenzhenernee Zhoornal.*

(*Conclusion*).

4th December.—During the night of 3rd—4th December Lieut. Kalmin succeeded in getting a 6″ gun of 120 *puds* (4,333¼ lbs.) to Pigeon Bay, and in mounting it secretly in front of the quick-firer entrenchments of Staff-Capt. Sirtsov. His intention was to strike the flank and rear of the Japanese during their expected fresh attack on Visokaya Hill, and in the course of the day he fired a few trial rounds. During the whole night the enemy kept up occasional artillery fire on the hill. At dawn the fire increased and attained the same proportions as on the previous day, and at the same time weak infantry parties kept annoying the garrison. Both sides carried on entrenching work with increased activity, and the whole day they kept up firing and bomb-throwing.

Movements of Japanese towards Visokaya Hill were noticed from Pigeon Bay and from other parts. And so, while the enemy rested and collected large reserves, the Russians had to wait prepared for the attack.

General Kondratenko and Colonel Semenov rode up to the 5th Regiment Headquarters and consulted with General Irman concerning Visokaya Hill. While arranging for resting the rank and file, Generals Kondratenko and Irman showed equal consideration for those in command. In Order No. 39 of the Western Front of the Land Defence, two reliefs of commanders for Visokaya Hill were detailed as follows:—In the first the director of the hill was Lieut.-Colonel Organov and the commandant Lieut. Ivashchenko, with Sub-Lieut. Rafalovich as his assistant, all three being of the 26th Regiment. In the second relief the director was Lieut.-Colonel Butusov, of the Frontier Guards, the commandant Capt. Solonikio, 27th Regiment, and his assistant was Ensign Kraushvili. The second relief took up the duties at 11 a.m. on the 4th December. At about 4 p.m. the 2nd, 3rd, and 4th Companies, 5th Regiment, set out for the hill. They had all passed a night in barracks, and all had been made up to strength with hospital men. They were commanded by Ensigns Foshin, Kondratiev, and Moskvin respectively.

As it was intended that these companies should be relieved on the next day, it became necessary to get a fresh draft of the 5th Regiment ready, and for this purpose the 9th, 10th, and 12th Companies were recalled from Flat Hill. They numbered altogether about 100 men, but in the course of the night they were made up with hospital rank and file and dismissed to rest in barracks, with strict orders to sleep out the rest of the night but at the same time to be ready at the first summons to come up to the headquarters, 5th Regiment—surely a rather complicated task!

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To replace losses among the officers of the 5th Regiment, Stessel sent up Sub-Lieut. Gudkov and Reserve Ensign Semenov. Gudkov arrived on the evening of the 4th December, and took over the 6th Company, 5th Regiment.

During the 4th, Naval Lieut. Lavrov, commanding the Aeronaut Detachment, was mortally wounded. Owing to the great losses which had been suffered on the right peak from artillery fire, part of the Aeronaut Detachment was sent to the spot, and Lavrov went with it. General Irman being on the hill, and not wishing to lose a good officer without special necessity, said to him, "You had better not go; I will find you some other employment." "No," answered Lavrov; "where my 'swallows' go, there I go too," and he went off with his party.

At this time the right peak was under fire from machine guns and occasional shrapnel. The sailors quickly reached the trench which had been allotted to them and began to take their places, Lavrov standing up to his full height to attract their attention. Suddenly a shrapnel burst within four paces of him and he fell. The first of the sailors who ran to his aid was killed by machine gun fire, but others lifted up their beloved commander and bore him to the dressing station.

5th December.—At dawn Lieut. Kalmin opened fire on the enemy, who had during the night crowded into all the trenches, approaches, and shielded places on the western slope of the hill. Several very good hits were observed, especially in the portion of the Ring Trench occupied by the Japanese, as after each a crowd of the enemy was seen to break away and run in the direction of Angle Hill.

When they tried to advance over the open in dense masses, Lieut. Kalmin's shells fell in the midst of their columns and on the very sky-line of the hill, which checked their advance and compelled them to move by small parties in rushes along approaches which they hastily built up with sandbags.

Their artillery also opened an answering fire, but as they did not see the 6″ gun, they directed their fire on Sirtsov's quick-firing gun position, so that the latter could be no longer occupied. Kalmin fired in all 98 shell and greatly assisted the defence.

On this day the observations from Pigeon Bay gave less useful results than hitherto, because the Japanese made use of their approaches and did not advance in the open. Thus to the observers it frequently appeared that no advance was in progress, and yet the terrible artillery fire on the hill, which raised clouds of dust and further impeded observation, left small doubt that something very serious was going on there.

What really happened was that from 6 a.m. the Japanese artillery began sweeping the hill with every nature of shell fire, and their now rested infantry harassed it in the most persistent manner. At this time the posts of director and commandant were held by Butusof and Ivashchenko respectively.

Kondratenko reached the 5th Regiment Headquarters at 7, and Colonel Semenov arrived some time later. Between 8 and 9 a.m. the companies in reserve were expressly summoned to the headquarters, at first the 6th and 12th, later on the 9th, and finally the 10th Company, 5th Regiment. The men had had no rest, as the 10th Company had only got in at about

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3 a.m., and the 9th Company only about an hour earlier, and it had taken a long time to reorganize them and complete them with hospital men before breaking off.

Between 10 and 11 a.m. the Japanese began to attack the hill, at first with small parties, and later on with larger ones. The Russian losses from artillery fire had been considerable, and the enemy had some success on the left flank. Alarming reports began to come in from the hill, and as these arrived, so the reserve companies were sent up; but as the Tea Ravine began to be swept by Japanese rifle fire, the advance of these companies was delayed, the men having to go by ones and twos, and in places by rushes. In consequence of this, they only reached the hill at about midday. Up to then nothing very serious had occurred, except that the enemy had got into the left redoubt.

The 6th Company, 5th Regiment, under Sub-Lieut. Gudkov, which arrived before the rest, was sent by Butusov to make a counter-attack on the left flank of the hill, while Butusov himself with Ivashchenko set to work to reorganize the retiring parties of riflemen. The 6th Company, going up by the communication trench, moved rapidly against the Japanese, led by Gudkov, who set a fine example of courage, and by his dashing conduct compelled the Japanese to fall back. After this heavy firing continued for a long while; the Japanese bombarded the hill with every description of shell, especially shrapnel, they swept it with the fire of rifles and machine guns, threw hand grenades, and occasionally cast mines. The Russian riflemen replied chiefly with grenades, and partly also with rifle fire, but they preferred grenades, as many of their rifles had become blocked by the dust thrown up by the heavy artillery bombardment. Lieut. Gudkov went the round of his men and encouraged them, joining in the fight with his revolver. After a time he was wounded, but remained on duty directing the action of his (6th) company, into the ranks of which many men from other companies had now become mixed, until he received a second wound and was rendered unconscious.

Meanwhile the Japanese waited patiently. Lieut.-Colonel Butusov used every endeavour to hold the hill up to the arrival of Lieut.-Colonel Organov, who was better acquainted with the ground. The latter was due at 11 a.m., but for some reason was delayed. Butusov, ill acquainted with the ground and exhausted by his night's work, sent frequent telephone messages, urging his despatch. These were passed to Irman, Kondratenko, and Colonel Semenov, but at 11.30 a message was received with news that he was dead. He had been mortally wounded, and only survived his wound for a few hours.

Capt. Ivashchenko, now left in sole command and appreciating the precarious state of the hill, collected some odd men and a party of newly arrived riflemen, and led a counter-attack against the left redoubt; but he was wounded in the right leg and carried to the dressing station. After this Lieut. Agafonov was appointed commandant. He had recently taken over the command of Fort No. 5 from Ivashchenko.

Kondratenko was very uneasy while Visokaya remained without a commandant, and he urged Agafonov to get there as quickly as possible. The latter started at once from Fort No. 5, and to please the General

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took a short cut, which however led him astray, and a long time passed without his arriving at the hill. Kontratenko, nervous and anxious for its fate, at about 12.30 appointed Capt. Solonikio to be commandant, Lieut.-Colonel Pokrovski to be director, and, as assistant to Lieut.-Colonel Seifulin who was keeping order in rear, Capt. Pobilevski. These appointments were made at the headquarters, 5th Regiment, and a considerable time elapsed before the officers arrived at their posts.

After Ivashchenko was wounded, for some time the sole command on the hill rested in the hands of Acting Ensign Abramov, 5th Regiment, who encouraged the men by the example of his personal courage, and besought them to hold on stoutly until assistance should come up; but owing to the large numerical superiority of the enemy a certain amount of ground was lost.

Meanwhile the companies of the reserve, which had been sent from the headquarters at 10 a.m., came straggling up, and Lieut.-Colonel Seifulin, who was posted to preserve order under the hill, appointed the senior of the new arrivals—Staff-Capt. Sazonov, commanding the 12th Company—as temporary commandant of the hill,

Sazonov forthwith set to work to organize a counter-attack against the Japanese who had taken possession of half of the left redoubt. This attack he superintended and led forward himself. At first all went well; the bravest men in the companies crept forward with grenades in their hands, and fairly soon gained the crest of the left redoubt. Gorielikov, a gallant young N.C.O. of the 12th Company, led the way, and the rest of the rank and file followed, with their company commanders well to the fore. The Japanese began to fall back. The counter-attack, in spite of the terrible fire and preponderating force of the enemy, promised full success, when unfortunately Sazonov fell insensible from a blow on the head from a stone or splinter. Almost at the same moment Lieut. Sirotko, commanding the 9th Company, was wounded in the head. Deprived of their commanders, the men lost confidence. They did not fall back, but distributed themselves in the recaptured works, and carried on a grenade fight with the Japanese, holding on to the hill as best they could, up to between 3.30 and 4 p,m.

At about 1 p.m. Lieut.-Colonel Organov arrived at the headquarters, 5th Regiment, and immediately set out for Visokaya. Kondratenko saw him, and prayed him to use every endeavour to preserve the hill. The telephone at that time was not working, because the connecting leads had been cut by Japanese shells. Reports were being sent by mounted volunteers, and were delayed accordingly.

At about 1.30 to 2 p.m. Irman rode up to the hill, and on his return reported to Kondratenko how things stood, and that everything depended on the sending up of fresh troops. At about this time a party of sailors arrived, and were immediately sent on to Visokaya. The urgent need of a reserve forced Kondratenko to draw four more companies from the Eastern Front and the centre, and also to beg for two companies of sailors from the General Reserve.

Just then things began to go badly on Visokaya; the artillery fire found many victims, and the groups of Russian soldiers grew thinner and

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weaker. At 3.30 in the afternoon the Japanese advanced to the attack in dense masses. From the weakness of their numbers and the want of reserves, the Russians were able to offer little resistance, and the Japanese easily captured the left redoubt and part of the saddle, while in other parts the fight went on stubbornly.

At about 4 p.m., from the headquarters, 5th Regiment, it could be clearly seen with field glasses, and even with the naked eye, that the Japanese had gained the crest of the hill, especially on the saddle, and were fighting the Russians with grenades, constantly advancing towards their left front, *i.e.*, from the left redoubt towards the right.

The telephone was again working, and each report from the hill became more alarming than the last. These reports took the form of conversations, and may be summarized as follows:—"The Japanese are advancing; they are pressing us back; the position is critical; reinforcements are necessary."

The last officially appointed commandant of the hill, Capt. Solonikio, fell about this time, though no details of his fate are forthcoming; and after him the command passed from one to another, until at 4 p.m. the *rôle* of commandant, in fact that of practically the whole charge of the defence of the hill, appears to have been held by Naval Engineer Losev, who had several times gallantly distinguished himself in the previous fighting. Thus for example on the 28th October, having collected some 20 volunteers, he advanced to drive the Japanese from one of the trenches which they had occupied. There was about a company of the enemy present. Coming upon their flank Losev threw a grenade, and the Japanese, surprised, rushed to one side, whereupon the volunteers leapt into the trench. Without allowing them time to recover, he advanced in front of his men throwing grenade after grenade, and pressed back the enemy step by step, until he had cleared the whole trench. After easily carrying out this and other comparatively straightforward tasks, this gallant sailor now found himself in a position of extreme difficulty, as he was called upon to assume the sole command of Visokaya Hill at a desperate moment, when with a terribly thinned line of six companies, in all about 300 men, he had to oppose three whole regiments of attacking Japanese. Little skilled in the fortifications, in the duties of commandant and in the complicated defence of the hill, he felt small confidence in himself, and sought for a man who might help him with advice on emergency. But by this time all the officers had fallen, and only by chance he found Sub-Lieut. Gudkov, who, having been wounded at mid-day, had lain for some time in an unconscious condition on the crest of the hill, until he had been picked up by the men and carried into the telephone blindage. After someone had hastily dressed his wounds, he remained lying in the blindage waiting for a stretcher, and getting a little warmer, he began to feel better. At about 4 p.m., when the overwhelming strength of the Japanese was clearly evident, in order not to fall into their hands, he decided to wait no longer for the belated stretcher, and was preparing to crawl to the dressing station when Losev, approaching the blindage for the purpose of holding a conversation with the 5th Regiment Staff, stopped him and appointed him his assistant.

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"Of what use can I be?" asked Gudkov.

"You as senior infantry officer can help me with your advice," answered Losev. "Lie as you are, only do not leave the hill until another commandant arrives to take the place of Solonikio, so that in case of necessity I may have someone to consult with." Gudkov agreed, and remained lying in the telephone blindage.

Meanwhile things were going from bad to worse. The small handful of Russians who remained on the hill was melting away with alarming quickness, and having no power to withstand the dense masses of the Japanese, was falling back step by step.

While reporting the critical state of affairs, the commandant begged for either reinforcements or orders as to what he should do. At this time reserves with all haste were moving from the Eastern Front and centre, and some companies were already arriving at the headquarters, a fact which was communicated to the hill. "Hold on a little, reserves are already arriving," was passed to the commandant; but the Japanese would not wait, and at about 4.30 to 4.45 he reported that the Japanese, having taken the left redoubt, were sweeping with fire the hill and its slopes, had taken the saddle, and were strengthening their attack on the right redoubt, in the maintenance of which no hope remained. In addition to this they were spreading over the top of the hill; the nearest of them were within 10 to 15 paces of the telephone blindage, and would soon cut it off and break the telephone connection. He begged permission to move down under the hill and take the telephone with him. In reply to this Staff-Capt. Baum, Chief of the Staff of the Western Front of the Land Defence, in the name of General Irman, did not sanction the removal of the telephone, and ordered him to defend the hill to the last.

A few minutes later, from the 5th Regiment Headquarters, they tried to ring up Visokaya Hill, but no further answer was received. And so the last time that Visokaya Hill spoke on the telephone was at about 4.30 to 4.45 in the afternoon of the 5th December.

Taking into consideration the state of things on Visokaya Hill, Generals Kondratenko and Irman, Colonel Semenov, and their Chiefs of Staffs, at 5 p.m., held a consultation in the headquarters, 5th Regiment, and decided at the approach of dark, *i.e*, from 6 p.m., to bombard Visokaya simultaneously from all the forts and entrenchments, and then to attack the Japanese with the fresh companies and drive them off. Orders were accordingly sent to all the forts and entrenchments of the Western Front to open fire with all their guns on Visokaya Hill, exactly at 6 p.m.

The 1st Foot Volunteer Detachment, 5th Regiment, which was now commanded by the newly appointed Acting Ensign Lavrov, was again summoned from Entrenchment No. 4. It had not been made up with hospital men, and numbered about 50 men. The command of the attack was entrusted to Lieut.-Colonel Organov, and for general supervision General Irman also rode up to the hill within a few minutes of 5 p.m. At 5 it began to get dusk, and by 6 almost complete darkness enwrapped the belligerents.

On the 5th December, in the afternoon, the Japanese also carried out an attack against Flat Hill, and again seized part of the Russian trenches,

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but were then driven out, on this occasion by one of the Hospital Detachments.

After Irman had ridden off from the headquarters, 5th Regiment, to Visokaya, Generals Kondratenko and Nikitin continued to watch the fight through their field-glasses. There was also present General Tserpitsky, Inspector of Hospitals, who had come over to look into arrangements in the section under attack. General Tserpitsky immediately set out for the foot of Visokaya to look after the preservation of order in rear.

As Kondratenko thought that the men would obey a general officer more readily than a newly appointed acting ensign, and that even the presence of a General would make a favourable impression on the troops, he begged Nikitin also to ride up to the hill, and consequently the latter, in company with his aide-de-camp, Lieut. Uspenski, went off soon after General Tserpitsky.

At this time the reserve companies moved up the Tea Ravine, the men going by rushes, either singly or in groups. In order to stop them the Japanese, having seized almost the whole crest of the hill, opened a terrible rifle fire, and now and then shells also came flying over. All movement in the ravine became extremely difficult and dangerous. Many who were wounded while passing through it came back again, but the dead were left lying in this ill-fated ravine, as there was no time to collect them.

Not more than a quarter of an hour after he had left the 5th Regiment Headquarters, Uspenski, aide-de-camp to General Nikitin, was carried back on a stretcher, wounded in the left side below the heart.

Irman had started at 5 p.m. on horseback, accompanied by two orderlies. Bullets whistled overhead and fell alongside him, but he rode on quickly, entirely in the open, presenting an excellent target to the enemy. About half-way his horse was wounded in the neck, and a second time in the mane, but hard ridden he continued his gallop until a third bullet, which raked him full length, breast, kidneys, etc., knocked him over. Irman succeeded in jumping clear, and an orderly flew to the horse, but immediately fell dead.

"Shall I kill it?" asked the other orderly, taking his place.

"No, take it back and have it attended to," answered Irman, and went on on foot to the hill.

After the General, a Sister of Mercy, Mme. Krik, drove up in a pair-horsed ambulance, and had just got down when the horses, frightened by the firing, from which one was wounded, turned and started back again full gallop, taking with them the driver, scared, and wounded in the leg.

A few minutes later a hospital cart came up and stopped under the hill; seated by the driver was General Tserpitsky, who as he began to get down was wounded by a bullet in the leg. A rifleman ran to his assistance, and with the driver lifted the wounded General from the cart, who was at this time again wounded by a bullet in the head. He was carried to the dressing station in an unconscious condition, and Sister of Mercy Krik dressed his wounds.

Carts loaded with cartridges and grenades drove rapidly to the hill, and rarely did one get through without having either driver or horses killed or wounded.

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Meanwhile, advancing by rushes, the reserve companies drew near to the hill. Capt. Pobilevsky received them. In advance of the rest there came up a company of sailors from the *Bayan*, and by 6 p.m. the following :—

A company (probably the 9th), 25th Regiment, under Sub-Lieut. Soloviev.

A company, 15th Regiment, without an officer.

Half of the 6th Company, 26th Regiment, under Ensign Golubev.

1st Foot Volunteer Detachment, 5th Regiment, under Ensign Lavrov, and apparently one more company, of which details are wanting.

The newly arrived companies were very weak (30 to 35 to 50 files), and the 1st Volunteer Detachment numbered only 50 men. In this way the force under Irman, although considerably strengthened, did not exceed from 800 to 1,000 men, and was too weak to retake Visokaya Hill, now occupied by 8 battalions of Japanese.

To take command of companies which had no officers, Lieut. Agafonov, 26th Regiment (who was detailed to the company of the 15th Regiment), Lieut. Sinkevich, Sub-Lieut. Nechay, 27th Regiment, and others also arrived at the hill.

At 5.30 p.m., Kondratenko, having discussed matters with several artillery officers, and having ascertained that the Russian artillery through want of shells could not do much good, but would rather do harm, as it would force the retirement of any of the men who might by chance be holding out upon the hill, and besides that, judging that the extra time would enable the Japanese to entrench more strongly the part which they had occupied, altered his decision to attack the hill, after first bombarding it with artillery from all the forts, and sent word to General Irman by mounted orderly not to wait for the artillery preparation, but to attack Visokaya as soon as the reserve companies should come up. Orders to cancel the firing were sent by telephone to the various forts and batteries, but probably these new orders did not reach them all in good time, because at 6 p.m. some of the forts, entrenchments, and batteries opened fire, all the same, on the very top of the hill; in the absence of definite information they supposed that the Japanese were on every part of it. The fire was not marked by good mutual combination, because only certain of the works were firing, and consequently it did no good; but, on the other hand, a handful of men who were apparently holding on to the right peak, and a group of the 2nd Company, 5th Regiment, under Ensign Fomin, who were still maintaining themselves on the left flank of the Ring Trench, and who had had no orders or information, on seeing that the Russian artillery was shelling Visokaya, concluded that the hill had been finally abandoned, and retired.

In doing this Fomin found that he had to burst through the Japanese outpost line on the southern slope (left flank) of the hill. The Japanese apparently had no suspicion of the presence of any Russians on the hill, because they were all looking keenly, and also firing, in the other direction, *i.e.*, towards the Tea Ravine. As it was already quite dark, Fomin collected together the remnants of his company (10 men), and after he had fired a volley into the enemy and thrown his last grenade into a column which he found in rear of them, which sent them rushing in alarm to one side, he rushed through with his men and happily reached False Hill, and

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eventually Tea Ravine. Here the men were unable to take part in the firing, because of the condition of their rifles; all were choked with dust, the greater number were quite unserviceable, and the rest could be used only very slowly.

The retirement of the party on the right peak was carried out entirely without incident.

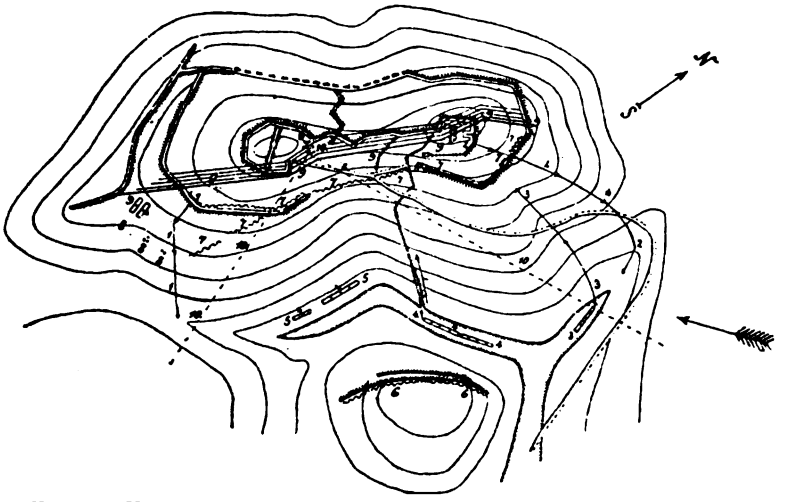

FIG. 9.—*Visokaya Hill. Position of the combatants at 6 p.m., 5th December.*

(1). Position and line of retirement of 7 to 10 men, 2nd Company, 5th Regiment, under Ensign Fomin.
(2). Line of retirement of last group of men from right redoubt.
(3). 1st Foot Volunteer Detachment, 5th Regiment, and the line of its attack.
(4). Centre column (advanced along the covered approach).
(5). Left column.
(6). 3rd Section, 8th Company.
(7). Japanese outpost line.
(8). A few individuals and small groups of Japanese.
(9). Line of Japanese reserves.
(10). Japanese machine gun, showing its arc of fire.

In this way the whole summit of Visokaya fell into the hands of the Japanese, who now dropped their shells on the rear slope and the foot of the hill. These shells fell exactly where the men of the newly arrived companies had been with so much difficulty assembled and got into order and arranged by companies. While carrying out this work Lieut.-Colonel Seifulin was wounded by a bullet in the arm, and was taken to hospital. The troops that were under the hill, and also their commanders, now knew that the Japanese had taken the whole hill, and the riflemen retreating from the right peak, by the news which they brought in, confirmed their doubt in future success, and threw a clearer light on the existing state of affairs.

Just after this Irman received the order for the immediate attack of Visokaya Hill, and with Organov, Pabilevski, and others, began to discuss the final arrangements. A large shell burst near this group, and the force of the explosion threw them from their feet and covered them with stones; but impressed with the gravity of the situation, they continued the consultation. It was decided to divide the force into three parts, and to

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move one against the right peak, the second against the saddle, and the third against the left redoubt. The right column was to consist of *one* company, the centre of two companies, and the left of one and a-half.

By this time it had become almost pitch dark, and the newly appointed company commanders, knowing neither their men nor the ground, were in a position of great difficulty. The newly arrived companies, unacquainted either with the ground or with their new commanders, were crowding together without confidence, while the Japanese dropped shell after shell at the foot of the hill and their infantry kept up a continuous rifle fire. All this added considerably to the difficulty of organizing the attack; but in spite of it the advance took place at about 6.30 p.m.

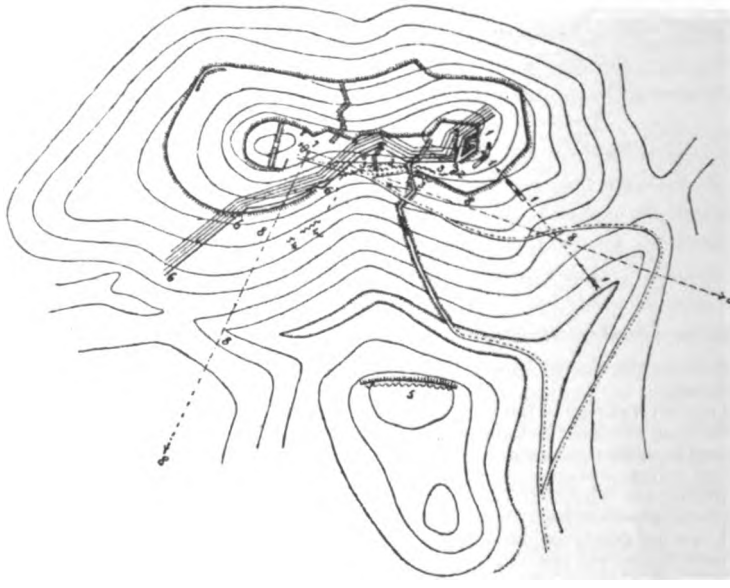

FIG. 10.—*Result of attack of General Irman, carried out at* 6.30 *p.m., 5th December.*

(1). Line of advance of the right column (1st Foot Volunteer Detachment, 5th Regiment). The portion of the redoubt occupied by them is shaded.
(2). Section under Sergt. Kibikin.
(3). Centre column. } Shown in their most advanced positions.
(4). Left column. }
(5). 3rd Section, 8th Company, 5th Regiment.
(6). The thick line shows the limit to which the Japanese were driven back.
(7). Japanese machine gun.
(8). Arc of fire of machine gun.

The 1st Infantry Volunteer Detachment was detailed for the attack on the right peak, the company of the 15th Regiment, under Agafonov, and half of the 6th Company, 26th Regiment, were told off to the attack of the left peak, while the *Bayan* company of sailors and the company of the 25th Regiment, under Soloviev, attacked the saddle. Each man was ordered to take with him two or three grenades, and they were encouraged to take more, as great reliance was placed in these weapons.

The companies, encouraged by General Irman and the other officers,

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and formed in column by the right, moved boldly forward, the centre column passing along the communication trench, which had been recently made by Ensign Ermakov. Between the left and the centre columns there advanced the 10th and the remnants of the 2nd, 3rd, 6th, and 12th Companies, 5th Regiment, and between the centre and right columns the remains of the 9th and 4th Companies and others.

The Japanese met this attack with a terrible fire. Every available weapon was brought into play; a machine gun, which they had succeeded in posting on the saddle near the left redoubt, and which brought a cross fire to bear on the whole slope traversed by the Russians, began to crackle, together with rapid rifle volleys; bombs were thrown, and the Japanese artillery directed all the fire of their artillery on the slope and foot of Visokaya Hill. Death filled the air, and at each step the killed and wounded rolled over in heaps. In spite of this, Irman, with Organov and Pabilevski, continued to clamber up the hill. It was evident that they had decided to conquer or die.

The hillside was covered with killed and wounded, but the living continued to move forward. The Volunteer Detachment on the extreme right flank, in spite of the terrible fire—they were fortunately covered from the machine gun by the northern slope of the hill—and suffering enormous losses, quickly climbed the hill, reached the right peak, and attacked it without delay. Charging with the bayonet, they succeeded in retaking half of the right redoubt.

In this success the Volunteers were greatly assisted by Sergt. Kibikin, who had taken command of the remnants of his 9th Company after Lieut. Sirotko had been wounded, and who also quickly climbed to the right peak, and by his supporting fire and successful grenade throwing in rear of the Japanese, who were being attacked by the Volunteers, forced them in spite of enormous numerical superiority to fall back. For this act Kibikin was recommended by General Kondratenko to be promoted to the rank of Ensign and to be decorated with a gold cross; but because he was not so rewarded on the spot, he is still a N.C.O., and wears no cross of the Order of St. George.

The success of this attack was also partly due to the fact that Irman himself assisted in its immediate superintendence, and encouraged the men by his personal example. The *Bayan* company was one of the first to scale the hill, but its commander was unfortunately wounded, and after this the men lay down in the path which led to the telephone blindage.

The gallant company of the 25th Regiment also pushed forward under Sub-Lieut. Soloviev, an officer whose deeds of valour had come especially under the notice of Kondratenko, and who, outstripping his comrades, gallantly climbed upward with his company, and reached the road to the telephone blindage, in fact, very nearly the top of the hill. Then, without waiting, he set to work to drive out those Japanese who were posted there and on the saddle, when he fell severely wounded in both legs by a grenade, and was carried to the dressing station, and subsequently to the headquarters, 5th Regiment. Here General Kondratenko had a long talk with him, asking many questions about the state of things on Visokaya, and promising to reward his gallant actions with the Order of St. George.

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His company, after it had lost its commander, also lay down approximately along the line of the road and opened fire.

The 10th Company, 5th Regiment, was now commanded by Sub-Lieut. Borodich. This officer, who belonged to the 28th Regiment, had been sent to take the place of Staff-Capt. Astafiev, who was killed on the 30th November. He became highly popular with the men, who would do anything for him. In their ascent, climbing over heaps of killed and wounded, they reached the same road, leading up from the telephone blindage. At this point gallant Borodich was killed, to the great grief of his men, who also lay down here and opened fire.

The left column rushed forward up the hill with the utmost gallantry, but coming under very heavy fire, they lost Lieut. Agafonov killed, and Ensign Goluber wounded, and lay down on the slope at a little more than half-way up. After they had lost their commanders, the men lying on the exposed slope also melted away under the cross fire of the Japanese. The corpses lay in heaps, and among them lay the survivors. Groans, the crackling of machine guns, and the explosions of shells and grenades filled the air with all kinds of noises, in which the voice of one man was completely lost. While keeping up their rifle fire, the men saw nothing but the dark silhouette of the hill and the flashes of the fire directed at them, heard nothing but the echoes and whistling of every possible form of deadly danger, and could only try more closely to crouch against the slope, which provided no cover, and which was being so appallingly swept with shells, grenades, and the bullets of rifles and machine guns.

All the efforts of Irman, Organov, and Pabilevski to make these companies get up and move forward were unavailing. After despatching Organov to the headquarters, 5th Regiment, to make a personal report of the state of affairs to General Kondratenko, Irman went down the hill, and finding there a large crowd of stragglers, he set to work to organize them into a single unit, with which he might support the companies lying on the hill and carry them forward. But he found this plan very difficult to carry out; some of the stragglers, through bad food, hard work, nine days' uninterrupted fighting, and other ills, were quite exhausted, others, from wounds received in previous fighting, were maimed and quite unable to mount the hill, and finally a third lot, having survived the horrors of the fight, had become moral cripples, and of all were the least fit for fighting.

Such was the state of affairs on Visokaya Hill at 8.30 p.m., when Irman, desiring an interview with Kondratenko at which he could personally explain the causes of his failure, handed over the command to Capt. Pabilevski and set off for the 5th Regiment Headquarters.

General Kondratenko, rapidly losing hope of recapturing the hill, was suffering severely from the disappointment, when Irman arrived and reported approximately as follows:—"The men are extremely fatigued and cannot climb the steep slope; they crawl a few paces and then stop to take breath, and consequently their attack has no vigour and they suffer enormous losses. The stronger men move forward more quickly than the weaker ones, but almost all of them have fallen under the terrible fire from the hill. Besides this, it is extremely difficult to direct the attack, it is so dark that nothing can be seen. From the explosions of shells and

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grenades, from the crackling of the Japanese machine guns, from the rifle fire, the shrieks of the wounded, and the cries of the combatants, the noise on all sides is so great that commands are not heard. The men are so keen on firing that nothing will stop them; it is necessary to shout orders to each man in his ear. The greater part of each company has fallen, and the survivors, collected together in groups, lie flat on the slope and fire. Unfortunately hardly anyone knows the ground; there are no officers—all have fallen. But in spite of all difficulties I led the men three times to the attack and obtained some success in places. But for complete capture of the hill the force is utterly insufficient; we require at least eight fresh companies more."

Having no spare companies at his disposal and unable to abandon the hill, Kondratenko was dissatisfied with this report, and after asking Irman several questions, he wound up the interview by saying:—"Do you wish me myself to lead the companies to the attack? Ride off there and attack again!"

Irman answered, "It shall be done," and turned to leave; but the officers present at the headquarters detained him for a minute. Well knowing the reckless bravery of General Irman, no one doubted that after this order he would go to certain death, and with no possibility of obtaining success, he would do his best to return no more. To each one it appeared certain that he saw Irman for the last time, and each tried to calm him and to persuade him not to sacrifice his life quite uselessly. M. Sliunin, the priest of the 5th Regiment, who was present, took an ikon and, blessing the General, hung it round his neck outside his sheepskin coat.

He then set out for Visokaya Hill in company with Capt. Gobyato, and found the conditions unchanged. The road to the telephone blindage was in several parts brightly illuminated by the woodwork of blindages and other works having been set on fire by the explosions of shells and grenades. The companies, now much thinned, were still holding the slopes in groups and carrying on rifle firing.

Irman and Gobyato collected some of the stragglers and led them up the hill. The Japanese, noticing the movement, re-opened a terrific fire, increased now by the fire of yet another machine gun.

Capt. Gobyato urging on the men started up the steep slope, but had only got about half-way up when he was hit by a bullet in the mouth and lower jaw, and went back to the dressing station. Irman, now unattended by an officer, went in the open up the slope, and gathering together from various parts a few handfuls of men, led them to the attack, throwing himself with drawn sabre in front of them, but found that he could do no good. It is astonishing that he should have remained uninjured. His orderlies were wounded, and his *gens d'arme*, though twice wounded while doing his duty and accompanying him, remained with his General until a third wound finally laid him low.

On his way from the dressing station to hospital, Capt. Gobyato called in at the 5th Regiment Headquarters and explained in writing, for he could not speak, to General Kondratenko, the state of affairs on Visokaya. His opinion was that either everyone in Port Arthur must be sent at once to the hill, or that it should be abandoned while it was yet dark and the Japanese could not see the weakness of the force attacking them.

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At any rate, to attack an enemy eight times stronger, and occupying, and entrenched in, a position of such strength as Visokaya Hill, was a matter of great audacity, to which the Russian troops had gone only on the strength of the brilliant results of their counter-attacks on the preceding days, and because the Japanese had acted without confidence.

The reports which were brought in by mounted Volunteers were short, delayed, and sometimes entirely lost. Consequently it was necessary to apply to the wounded officers who were brought in from the hill, and most of the information received was obtained from this source. This information was very unfavourable and left little hope of success, but Kondratenko was unwilling to believe it. How many times already had they survived alarms on Visokaya? How many times had he lost all hope and sent one or two companies in haste, rather to cover a retirement than to support an advance, when he had received the entirely unexpected news that the hill was re-captured? In his heart he was awaiting yet once more news of success.

But after he had received Gobyato's report, he decided to call a council of war, and summoned first Lieut.-Colonel Organov, and later General Irman also, to explain the existing state of affairs. After hearing from these others reports to all intents similar to that of Capt. Gobyato, he said sadly, "Now begins the death agony of Port Arthur," and then after a short silence he sent round to summon the council.

A table was put into the room, which previous to the fighting had been occupied by Colonel Tretyakov and Lieut.-Colonel Seifulin, and which had previously been a model of neatness and cleanliness, but was now deserted and disordered, with unnecessary rubbish thrown about the floor. On the table was unrolled a large plan of the fortifications of Port Arthur, and around were arranged a stool and a few benches. In the centre sat General Kondratenko, with Colonel Semenov by his side, and the rest sitting and standing round the table in two rows, irrespective of ranks. Irman and Organov had returned to their troops under Visokaya.

The state of affairs was briefly as follows:—From all places where men could be withdrawn without actual danger everyone had been taken, and had perished on Visokaya Hill. Of those who remained there were insufficient to re-occupy and hold the hill unaided. Besides this they were extremely exhausted by the 10 days of uninterrupted fighting, and could hardly move.

The Japanese were quite firmly established on Visokaya, and at the same time carried forward their attacks on the centre and right flank of Arthur. No one doubted that their main objective was Visokaya Hill, and that the other attacks were merely demonstrations; but it was quite impossible to make use of the companies in the attacked areas. It was necessary to hold on at least to what was not yet lost.

After informing those present of the existing state of affairs, Kondratenko put a question in this form:—"Can anyone give a suggestion as to how Visokaya Hill can be preserved?" After some silence, various remarks were heard, from which the general opinion was clearly shown that, with a sufficient number of fresh troops and with complete artillery support, it might be possible, but such resources were not at their disposal. To the question "Is it not possible to save Visokaya with

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available resources?" all present, fearing to grieve their already saddened comrades, merely shrugged their shoulders. The spirit of hope and confidence which had existed up to the 30th November was now changed to despondency and apathy.

At first General Kondratenko wished to adopt the former method of saving the hill, *i.e.*, by bombarding it with the artillery from the forts, and again attacking it with all available forces; but then he hesitated and renounced this plan, for the reason that the artillery, through want of ammunition, gave no hope of success. An example lay before us. At 6 p.m. the artillery had fired, but it had given the infantry no assistance. Added to this, at any rate on the right peak, the Volunteers were somewhere holding on, and it would not do to risk shelling their own men.

"And so, gentlemen, no one can propose a way of preserving Visokaya Hill?" said the General, casting a lingering glance around those present; and when he had recognized that this was indeed the case, he decided to abandon the hill, and put forward the following question:—"What position shall we now occupy, *i.e.*, shall we hold Flat, False, and Division Hills, or retire to the line of the original position, between Forts Nos. IV. and V., including Red and Fougasse Hills and the New and Two-Angled Lunettes?"

Here followed a short but animated interchange of opinions, from which it was decided that the second position was the more suitable, because with the fall of Visokaya the strength of Flat and False Hills had been lost, as the near distance and the great command of the first gave to the Japanese the power of raking their trenches, and of observing each yard of their defences, with a view to attacking at a favourable moment. The whole of the Tea Ravine was clearly seen from Visokaya, and all passage along it of provisions, cartridges, grenades, or reinforcements in the daytime must be finally put a stop to. Further, if the Japanese by a successful attack should occupy these hills by daylight, the garrisons retiring along the ravine under fire from Visokaya must inevitably be destroyed; and it was surely a mistake to risk whole companies where men were so short.

But the main advantage of the second position lay in the fact that it was only half the length of the other and gave the power of saving several companies. Its fault lay in the trenches, blindages, and other works, which were greatly inferior to those erected with so much trouble on Flat and False Hills, and which had not as yet been completely destroyed by the Japanese artillery. But this fault was not a serious one, since the distance of the Japanese trenches from the new position was at least a verst, while from the old position it was only some 50 to 70 paces; and while the Japanese were advancing over this distance the Russians would have considerable time to improve the condition of their works.

And so it was decided to occupy the position from Fort No. IV., through Two-Angled and New Lunettes, and Fougasse and Red Hills, to Fort No. V.

Orders for carrying out this decision were sent at about 11 p.m. to the various companies. Division, Flat, and Fougasse Hills were to be evacuated during the night, and all necessary stores were to be brought to the new position, every precaution being taken that the enemy should not notice what was going on. In order that the Japanese should not advance into the Tea Ravine before dawn, and by doing so upset the

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plan for occupying the new position, General Kondratenko sent Lieut.-Colonel Zubov to take command of and reorganize the troops under Visokaya, with orders to hold back the Japanese at all costs the whole night and retire at dawn, after demolishing all works which had not yet been wrecked by shells, and which might be serviceable to the enemy.

Irman and Organov started back on their way to the headquarters at about 10 p.m., and Pabilevski remained in chief command under Visokaya. At this time there was a distinct lull in the firing, and the gallant Sub-Lieut. Nechay, 27th Regiment, who was commanding several companies of the 5th Regiment, noticing this weakening of the Japanese, decided personally to satisfy himself as to where they exactly were, and in what numbers.

In vain did Pabilevski tell him not to do this, and with three or four Volunteers he started on his rash reconnaissance. He crept to the top of the hill and stopped before the low parapet of a newly completed Japanese trench. Cautiously raising his head, he began to look around, and the Volunteers did the same. Just then the Japanese began to fire; Nechay's forage cap flew high into the air, and he and two of the Volunteers remained motionless while the rest crawled rapidly down.

Shortly after this Pabilevski was appointed to the command of the newly occupied original position, and he was recalled to headquarters to receive his instructions. Lieut. Sirotko, who was lying wounded in the dressing station in a blindage, took his place, pending the return of Irman and Organov; but he did not hold the command very long, as the others soon returned, and at about 1 a.m. Lieut.-Colonel Zubov also came up to superintend the retirement.

Each of the companies posted on Flat, False, and Division Hills, on receiving instructions for their retirement to the new position, was divided into two parties, one of the uninjured men and the other of the remainder. The able-bodied half-companies were at once loaded with stores, and under the command of N.C.O.'s started for the new ground, while the rest, with the company commanders, remained to guard the trenches.

At about 1 a.m. the able-bodied men reached their new positions, deposited their stores under guards, and at once returned, so that at about 2 a.m. the companies were again at full strength. Then in each company from 12 to 20 Volunteers were chosen to cover the retirement. These men were to remain in the trenches for about an hour after their company had left, and extended in a thin line were to fire and throw grenades at the enemy, so that he should not discover the retirement. At about 3 a.m. the companies left their ruined trenches on Flat, False, and Division Hills, and at about 4.30 the Volunteers also retired.

That the retirement was entirely unnoticed by the Japanese is shown by the fact that, in their official report of the occupation of Flat Hill, it is stated that the Russians posted there could not hold it under the fire from Visokaya and from other points, and were obliged to retire, and that in consequence of this the hill was occupied by them at 1 p.m. on the 6th December. There is no mention of the occupation of False and Division Hills in the report. This shows that they were taken still later, in fact, it was not till about 2 p.m. on the 7th December that, after a powerful artillery bombardment, they attacked Division Hill and took it without loss.

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On the 7th December Sub-Lieut. Galileev, 5th Regiment, with Volunteers from his own (11th) and the 8th Companies, carried out a sortie from Red Hill against False Hill, and found that the side of it facing the Russians was unoccupied, while the other side was held only by a picket.

The companies posted under Visokaya Hill waited till dawn on the 6th December, and then retired in good order to the original position, covered by Volunteers and by the units which had suffered less seriously than the rest. The Japanese could not have failed to notice the retirement of these last detachments, but they contented themselves with pursuing them only with rifle fire.

During this day, the 6th December, Naval Engineer Losev and Sub-Lieut. Gudkov, with a wounded rifleman and a telephonist, were taken prisoners in the telephone blindage on Visokaya. It will be remembered that at 4.45 p.m. on the previous day Losev had reported by telephone the critical state of affairs, and had begged permission to leave the hill and carry down the telephone, but had received orders to hold on. Meanwhile the Japanese had already reached the blindage and dropped down into the approach leading to it. Fearing that they might get into the blindage and make use of the telephone to listen to orders from the Russian staff, Losev barricaded himself in the blindage, hoping to get out again when the hill should be retaken. But this did not take place. All night long bullets and splinters of shell whistled past, machine guns crackled, and hand grenades burst on it or near it, threatening to set it on fire. By dawn the sounds of the firing receded, and it became evident that the Russians were retiring. They consulted together as to the best way to escape, and decided to wait for the night, hoping that in the darkness they might succeed in slipping past the Japanese, who were moving about near the blindage and over the whole hill. Unintentionally they all went to sleep, and were thus captured.

On this day, also, a wounded rifleman came in, and stated that he had remained after the rest had retired in the dressing station, where he had been found by the Japanese, who treated him kindly and dressed his wounds, and one of their doctors had spoken to him in Russian. He said that the Japanese were all laughing; probably they were delighted at the capture of the hill.

On the 7th December, at dawn, two riflemen came in from Visokaya, and said that by a miracle they had escaped injury in a ruined blindage, and subsisting on biscuits, were waiting to be dug out, when they found that the fighting on the hill was finished, and that Japanese voices were heard on all sides. Using their combined efforts to enlarge the opening of a loophole, after about 24 hours' work they made it large enough to climb through. Going cautiously down the hill and taking the direction of False Hill, they nearly ran into a Japanese picket, but thanks to the loud talking of the Japanese soldiers, they discovered it in time, and turned in the direction of Tea Ravine. When they had avoided the last Japanese post, they got up and began to run. A dog ran after them and the Japanese fired a few shots, but did not follow them. They were the last to leave Visokaya Hill.

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RESULTS.

When they had taken the hill, the Japanese established an observation post on it, from which they were able to correct the fire of their 11″ guns on the fleet, and in the course of three or four days they sank all the battle-ships which had taken cover under the land defences in the inner roadstead.

The Russians saw with pain and disgust the shameful destruction of their fleet. One after another, large and small, they were struck and foundered in the shallow waters of the inner roadstead, now called sarcastically the "Haven" or "Mouse Trap." Only the gallant commander of the ironclad *Sevastopol*, Capt. Essen, not wishing to expose his ship to such a fate, took her into open waters and moved to the outer roadstead of the White Wolf. Almost daily did the Japanese throw 11″ shells at this ship, right over Arthur, and almost nightly they attacked her with torpedoes, in which they sometimes lost torpedo-boats; but it was not till the end of December that they so wounded her that there remained nothing for her heroic crew but to sink her. Then Essen took her out into 150′ of water and sank her. A heroic resistance; and even the very fact of sinking her where he could rely upon her total loss encouraged the land garrison and drew great sympathy towards her crew.

The Japanese, observing from Visokaya Hill everything that went on in the New Town, were able practically to stop any movement about the streets by daylight. They also fired by night; but this firing was only at random; while by day they threw shrapnel from guns posted on Visokaya at every passing wagon and cart, every group of men, and even at individual passers-by.

Besides this the hill played an important part as an observation post in the attack on Forts Nos. II. and III., Entrenchment No. 3, and the Great Eagle's Nest.

Tactically, in Visokaya Hill the Russians lost and the Japanese gained the strongest of all the temporary defences of Port Arthur, a commanding height and key to the Western Front, and, in some opinions, to all Arthur. The loss of Visokaya was especially felt by the works of the Western Front, which it took in flank and rear at a short range, as, for instance, Fort No. IV. Besides this a direct road into New Town—the Tea Ravine—had been thrown open to the enemy. *Morally*, the fall of the hill had a very depressing effect on the garrison, and greatly encouraged the Japanese.

The men now posted in new positions, which were neither naturally nor artificially notable for their strength, instead of engaging in cheerful conversation, kept their eyes sadly directed against the threatening, depressing form of Visokaya Hill, covered with the black craters of 11″ shells, like the festering sores of some terrible illness. They did not fail to see the importance of the position and the power of its works. They recognized that every effort had been used in the struggle for its defence, and that each man, sparing neither life nor strength, had loyally done his best, had fought to the last, and yet the enemy had conquered—evidently he was stronger than they!

The conversations on such occasions sometimes turned into grumbling

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against those in command, who, when Flat, False, and Division Hills were abandoned, had forbidden the men to set fire to the uninjured buildings and stores which were left behind. This was done to conceal the retirement, but it offended the men that blindages built by their hands should preserve their enemies from the cold.

The desperate struggle on Visokaya had so thinned the garrison and weakened its numbers that it had lost the power of making a sufficiently strong defence of the remaining positions. Want of men and the absence of reserves was noticeable everywhere, and this, in the writer's opinion, was the chief cause of the failures which brought about the fall of the fortress.

It is very difficult to fix the exact number of the Russian losses in this fighting, because the troops which took part in it included, besides the whole of the 5th Regiment, many combatant, non-combatant, and composite companies of other Arthur regiments and Reserve Battalions, Hospital Detachments and sailors. In all, more than 80 companies and detachments took part in the fighting on Visokaya and Flat Hills, some of which had completely disappeared in the fighting, and others, Hospital Detachments and Reserve Battalions, were now drafted into other units, and of their losses it is very difficult to form an estimate. But the total loss in killed and those of the wounded who were taken to hospital certainly exceeded 5,000, and if the wounded who continued to perform duty are included, the total was probably nearer 7,000.

In the 5th East Siberian Rifle Regiment alone, out of 23 officers, 26 ensigns, and 1,805 rank and file, in which number the non-combatant company is included, as it was present throughout the fighting on Flat Hill, the following casualties were sustained:—14 officers, 17 ensigns, and 1,251 rank and file, in which number the proportion of killed was about one in four.

If it is estimated that the Japanese in this fighting lost twice as many men as the Russians, *i.e.*, 10,000, and that their army had previously numbered 100,000 men, which was about five times the strength of the Russian troops employed on the positions at that period, it will be seen then that after this fighting they remained six times $\left(i.e., \frac{100 - 10}{20 - 5}\right)$ as strong.

And so the desperate struggle on Visokaya Hill and its fall influenced very strongly the fate of the fortress, and were, so to speak, the turning point in the direction of the failures which led to its fall. Well may Kondratenko have said when he saw no means of preserving Visokaya Hill, "This begins the death agony of Port Arthur."

In conclusion, the author describes how at the end of the war he obtained three days' leave from the Prisoners' Camp at Sizooko and paid a visit to Tokyo. He and his companions did a great deal of sight-seeing, and visited among other things the museum, which already contained a large collection of Russian arms and equipment; but their interest was aroused at a fairly late hour on the last day of their visit by hearing that in a certain garden a feast of chrysanthemums was being celebrated by

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means of pictures, made almost entirely of live flowers and foliage. Hastening to the spot, they found that the garden was divided into four parts, in each of which were exhibited two large and two to three small pictures, illustrating popular scenes of Japanese legends and history. The majority of these naturally had reference to their recent war, and the place of honour was given to a large representation of the final struggle for 203-Metre Hill.

A large crowd was gathered round this picture, and, with the help of an interpreter, the writer was able to understand that among the Japanese the fighting on Visokaya was admired beyond any other incident in the war. Nowhere did they meet with such resistance, nowhere were the methods of fighting so ghastly, and nowhere did the Russians show themselves so courageous, resolute, and persevering, as on this occasion.

When the Japanese decided to erect at Port Arthur a monument to the fallen Russian soldiers, in honour of the gallant deeds of the garrison, and sought to place it on the spot which was most glorious to the defence, they decided upon Visokaya Hill. Surely this fact is more eloquent than words.

And yet this is far from being the way in which the Russians look upon the gallant actions of their own troops. In a slough of intrigue, and stirring up all possible dirt, they apply a magnifying glass to the microscopic blots in the grandest struggle of the war, and while unsparingly baiting the seniors of the garrison over small trifles—very often invented and always exaggerated—they leave themselves no time to notice and reward the gallant deeds of those who took an actual part in the defence.

In conclusion, as the name of Tretyakov is so inseparably associated with that of Visokaya Hill, the author adds the following short note on his previous career :—

General Tretyakov, at that time a young Sapper officer, earned considerable distinction during the Siege of Plevna. During the China War, at Hunmir, a small Russian force, consisting of two companies, 5th Regiment, and a company of Sappers, was attacked unexpectedly by large masses of Boxers, but was saved by the courage and resourcefulness of Colonel Tretyakov, who threw himself forward, leading on his men, who were paralyzed from surprise, and finally dispersed the Boxers. Finally at the Battle of Kinchow he and his regiment greatly distinguished themselves, and sustained the attack of three Japanese divisions.

F. E. G. SKEY.

Note.—In the portion of this Transcript which appeared in the October and November *Journals*, the dates given have been wrongly transcribed from the "old" to the "new style," and should really be two days earlier than shown.

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REVIEWS.

LA MANŒUVRE POUR LA BATAILLE.

By Colonel of Artillery F. Foch.—(Berger-Levrault et Cie. 10 frs.).

This book is the sequel to *Principes de la Guerre*, which was reviewed by Capt. Sewell in the *R.E. Journal* of May, 1907. It consists mainly of a critical strategical account of the action of the German armies in 1870, up to August 18th, with particular reference to the 1st and 2nd Armies. The author first briefly considers the object and direction of a campaign and the preparations to be made during peace time. The conclusions arrived at may be summed up as:—Detailed preparations leading up to the first battle; then further movements in accordance with the needs of the fresh situation, but always in conformity with the end in view.

The author next proceeds to discuss in detail Moltke's memoir of 1868–9, and from his remarks about present-day preparations he seems to think that France has more railways than are necessary for concentration on the north-east frontier. This would give her a choice of several lines of action, and enable her to reply to the German idea of carrying out a preconceived plan, seizing the initiative, and forcing the enemy to conform to their movements by the rapidity of their action, by carrying out a plan—prepared indeed beforehand, together with several others—but only chosen at the last moment and thus creating a strategic surprise.

The main themes of criticism thoughout the book are:—The lack of a strategical advanced guard to the German forces, the great distance from the front at which the Royal headquarters remained, and the preference of Moltke and Prince Frederick Charles to base their actions on hypothesis as to what the French ought to be doing, rather than on information as to what they actually were doing. Moltke did indeed twice order masses of cavalry to be pushed forward, but in the second case—the occasion of the passage of the Moselle by the 2nd Army—Frederick Charles had allotted all his cavalry to separate corps, and could only dispose of two brigades. The cavalry divisional commanders, too, by no means fulfilled the very moderate demands made on them by headquarters. But while criticizing, from the strategical point of view, the manner in which the German forces were led, Colonel Foch does full justice to those moral qualities in the leadership which enabled the Germans to gain victories despite their mistakes—the determination to win, and the initiative and loyal co-operation of the subordinate commanders. He contrasts with this the conduct of the French leaders at, and in the neighbourhood of Spicheren on August 6th, the supineness of

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whom Colonel Foch declares to be the chief characteristic on the French side. They obeyed only the letter of their orders; each considered his own situation, with the conviction that he could not count on his neighbour; he felt himself alone and involuntarily looked to the rear. The causes of this lay in a steady centralization and repression of all initiative. Moreover, the natural qualities of the French were ignored, and the advantages of fire and of the defensive—*i.e.*, of immobility—were impressed upon all.

In his account of the Battle of Vionville the author is full of praise of Prince Frederick Charles' decision, so strongly condemned by Moltke, to order the last German attack. Throughout the day it was only the moral superiority of the German leadership which enabled two German corps to make head against the whole French Army, and this last order to attack was, in Colonel Foch's opinion, the crowning example of this superiority. The men were exhausted, but "the will of the leader must dominate the troops." In the centre the guns were ordered to advance, "not with the hope of securing material effects, but to affirm the will to conquer and the power to advance." The same spirit was shown two days later at St. Privat, when at 7 p.m. orders were sent to the last reserves, the II., X., and most of III. Corps, to join in the attack.

Though one or two of the author's arguments may not be entirely convincing, yet it is altogether a most interesting book, and gives a good idea of the modern French doctrine of the strategic advanced guard.

C. F. STOEHR.

NOTES ON GERMAN FIELD TELEPHONES, AS LAID DOWN IN "ARTILLERIE UNTERRICHT."

(From a translation by Capt. A. H. Ollivant, R.G.A.).

Each (German) battery of field or horse artillery has three telephone "stations," each consisting of two men; in the horse artillery all the "stations" are mounted, in the field artillery only one.

The equipment of a "station" consists of—

(*a*). A portable telephone apparatus, with hand telephone and buzzer call, and an additional headgear receiver.
(*b*). A telephone receiver, with calling switch and a megaphone attachment.
(*c*). Six drums, each containing 500 yards of cable.
(*d*). Three signalling flags.

In addition there is a reserve for each battery, containing two telephone sets, 30 rolls of 500 yards of cable, an acetylene signalling lamp, and various spares.

The "hand telephone" is somewhat similar in appearance to telephone hand, C, Mk. II., and is of the "Mix and Genest" pattern, which was tested

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by the R.E. Committee a few years ago, but was not adopted. The portable set is carried in a leather case, which is fitted with a carrying strap, but is carried in the knapsack.

The telephone receiver (*b*) is used in double stations or intermediate posts. It is carried in a case on the waistbelt, along with the megaphone attachment.

The cable (M96) consists of 2 tinned steel and 1 copper wire, surrounded with tape, and waterproofed with wax. Breaking strain, 66 lbs. [Our D1 has seven strands and a breaking strain of 140 lbs.].

The apparatus is carried by a mounted "station," as follows:—

By the "telephonist"—

Portable telephone on his back.
Battery, rear of saddle, near side.
Case containing two reels of cable, rear of saddle, offside.

By the "orderly"—

Telephone receiver (*b*) on belt.
A case containing two reels of cable on each side of saddle.
Signalling flags in a carbine bucket.

The cable is laid on the ground and is afterwards raised on to trees, etc., if possible. It can be laid from horseback at any pace required. Winding up is always performed on foot, the horse being led. All officers, telephonists, scouts, orderlies, and horseholders are to be trained in the use of the apparatus, and also in visual signalling (Morse code).

The telephone apparatus is apparently used both for the brigade connection (O.C. brigade to O.C.'s batteries), and for the battery communication (observing station to battery). Apparently one of the "reserve" sets is used at the battery, so that for a brigade of three batteries there are 12 telephone sets and about 8 miles of cable available, which corresponds very closely with the numbers in the British Army. In the latter however a heavier cable, carried in and laid from a wagon, is used for the longer lines of the brigade connections.

E. G. Godfrey-Faussett

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NOTICES OF MAGAZINES.

ELECTRICAL REVIEW.

1st October, 1909.

DAMAGE BY LIGHTNING (*p.* 536).—Damage to buildings from lightning stroke is practically preventible. The only means of ensuring safety is Franklin's system propounded 150 years ago, namely, by placing metal rods above the loftiest pinnacles, and continuing the lines of conduction down to moist ground. On the score of cost contracts are often given to those who put in a poor system. Only about 2 per cent. of buildings fitted with conductors are damaged by lightning; this is a proof of their value even when improperly applied. The author states that a defective conductor is usually better than none, and gives a certain amount of security by causing damage to be done at less vital spots. Inspection and maintenance of systems is absolutely necessary, but frequently neglected. Inspection is required to see that new metal work put into the building is properly dealt with.

15th October, 1909.

ELECTRIC MASTER CLOCKS FOR MAURITIUS OBSERVATORY.—An impulse is given to the pendulum every second by a weighted lever, which trips at every swing of the pendulum, and in falling gives it an impulse. The lever closes the contact of an electro-magnet and is lifted back to its original position. The beat can be temporarily retarded or accelerated electrically.

TROLLEY OMNIBUS (*p.* 634).—A demonstration of railless electric traction was given in London. The object of the system is to enable electrically propelled vehicles to run on ordinary roads instead of only on special tracks, and at the same time to draw their motive power from overhead lines.

22nd October, 1909.

TECHNICAL GUARANTEES.—Under this heading an article in *Engineer* is referred to, and the point emphasized is that—"Too much reliance must not be placed on guarantees given by contractors before acceptance, especially those of an exceptional nature."

WATER FROM BOREHOLES.—Considerations as to necessary depth and permanence of water supply are dealt with, and it is claimed that such holes are frequently bored too deep.

29th October, 1909.

COMPARISON BETWEEN PARSONS AND CURTIS TURBINES (*p.* 683).—Defects and advantages of each type is given, and as the former is not so efficient at the high pressure end, but very efficient at the low pressure end, a combination of two types is advocated.

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EVAPORATIVE CONDENSERS.—These condensers consist of stacks of tubes, over which a small amount of cooling water trickles. This evaporates and gives low temperature.

12th November, 1909.

SEALED CARTONS FOR M.F. LAMPS (*p.* 777).—These are now being introduced, and the lamps can be examined and tested while in the carton. If found defective, they can be returned to the maker, and so long as the seal is unbroken they will be replaced.

15th November, 1909.

ELECTRIC LOCOMOTIVE.—A description of a steam electric locomotive, manufactured by North British Loco. Co., Glasgow, is given. The boiler is of the ordinary loco. type fitted with a superheater. The engine is a turbine of impulse type, connected to a continuous current generator, whose voltage can be varied between 200 and 600 volts. As there is no oil from the turbine, an ejector condenser is used; condensed steam and condensing water are mixed together, and pass to a common tank, from which the boiler feed water is drawn. The cooler is placed in front with turbine driven fan. There is forced draught for the fire, and there are four series-wound traction motors. Two 8-wheel compound bogies carry the engine; each bogie has two driving axles, on which is a motor apiece. The engine is intended for express passenger work, so that it will be possible to make comparative tests between it and ordinary standard engines.

19th November, 1909.

FURTHER CORRESPONDENCE ON LOW VOLTAGES FOR COUNTRY HOUSE INSTALLATIONS (*p.* 807).—Voltages as low as 4 are mentioned. These low voltages allow low c.p. lamps to be used, as well as a small number of accumulators, but prevent arc lamps from being installed, require very large copper mains where many lamps are used, and are not so suitable for electric heaters and motors.

CONTINUITY GRIPS (*p.* 809).—The wiring rules of the Institute of Electrical Engineers require all systems of metallic conduits electrically to be continuous. To bring various "slip joint" systems within these rules, "continuity grips" have been introduced, so as to avoid replacing such systems already installed by screw conduit work.

BRIEF RÉSUMÉ OF LECTURES ON ELECTRIC RAILWAY WORKING GIVEN AT INSTITUTION OF CIVIL ENGINEERS (*p.* 813).—Experiences of three systems are given, namely, Heysham, Mersey Railway, and Tynmouth branches of N.E. Railway. The first mentioned is single phase A.C.; the two latter C.C.

LIGHTING SCHEME FOR A SMALL VILLAGE (*p.* 837).—An article on this subject shows that where water power is available electric light can be supplied commercially at *low rates* even *for small* installations.

26th November, 1909.

ELECTRIC IGNITION FOR INTERNAL COMBUSTION ENGINES (*p.* 850).—The article gives a description of the various types, viz., accumulator and coil,

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high and low tension magneto, lodge system, and synchronized system. Comparing the magneto and the coil ignition, the author states that the magneto is the more expensive in initial cost, but the mechanism is more simple, compact, and reliable. Greater power is obtained when using magneto, because, as the speed of the armature increases, the spark produced becomes larger and hotter, and combustion commences and progresses more rapidly.

2,000-H.P. MOTOR-DRIVEN LOCOMOTIVES FOR PENNSYLVANIA RAILWAY (*p.* 878).—A description and pictures are given of these locomotives. The loco. is of the articulated type. Each half weighs 150 tons, and has four 68" driving wheels.

3rd December, 1909.

TELEPHONE SYSTEMS (*p.* 915).—In a lecture on this subject stress is laid on the necessity for speed in dealing with calls in the exchange. The following advantages are claimed for the central battery system. It dispenses with local batteries and generators; it keeps the lines permanently under test; it concentrates responsibility and supervision on the switchboard; and it gives greater uniformity of speech. A wider use of telephones in offices and workshops is advocated.

10th and 17th December, 1909.

LOADING OF TELEPHONE CABLE CIRCUITS (*pp.* 953 and 993).—In any telephone circuit there are four factors which exert an influence on transmission. These are (*a*) resistance; (*b*), inductance; (*c*), electrostatic capacity; and (*d*), reciprocal of the insulation resistance. The investigation of their joint influence on the transmission of speech is a matter of some complexity, and is dealt with at length.

TRANSMISSION OF ELECTRICAL ENERGY (*pp.* 956 and 995).—Water-power schemes and long-distance transmission lines are more common in America than in Europe, largely owing to the cheapness of wayleaves. A 110,000-volt transmission is mentioned, but 60,000 volts is the usual limit. Modern practice of hydro-electric plants is discussed. The capital costs appear to be from £20 to £30 per k.w. installed, as against £10 for steam turbine stations.

A. E. DAVIDSON.

LE BULLETIN.

EMPLOYMENT OF FIELD ARTILLERY.—In the June number of the journal General Langlois contributes an article on the employment of field artillery in conjunction with other arms, which is also continued in the July number.

SAPPER CYCLIST DETACHMENTS.—Under the heading of Foreign Military Intelligence there is a brief description of the sapper cyclist detachments which form part of the French light cavalry divisions. Each of the four divisions has one such detachment allotted to it, its strength being 1 officer, 3 drivers, 31 N.C.O.'s and men. The detachment carries 40 lbs. of mélinite and a certain number of technical tools on their bicycles.

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Additional technical and bridging stores and explosives are carried in two wagons, which, with a G.S. wagon for regimental stores, form the 2nd line transport of the unit. The bridging stores are chiefly lashings and waterproof bags, each of the latter carrying four men in marching order or five men in fatigue dress. The full load on the bicycle is 40 lbs., excluding the rider. The men are armed with the carbine and short bayonet.

August, 1909.

Reorganization of the French Artillery.—The evidence, taken before the Military Commission, as to the merits of 4-gun as opposed to 6-gun or 8-gun batteries is given at some length. The 4-gun organization for field batteries has been definitely adopted. The reorganization will be complete in two years' time, and will provide 634 field batteries (75 m.m.).

Austro-Hungary.—In the Foreign Military Intelligence it is stated that Austro-Hungary is experimenting with an explosive rifle bullet, designed to produce a puff of smoke on percussion, for use in ranging.—The War Office is said to be purchasing two dirigibles of the Parseval and Lebaudy types.

October, 1909.

The Reform of Military Law in France.—An Act for the suppression of courts-martial in time of peace was passed by the Lower House on June 11th, 1909. It provides for additions to the Civil Code, to enable military offences to be dealt with by civil courts, aided by military juries, which will include N.C.O.'s and men.

A list of penalties is given, and these certainly do not err on the side of leniency, *e.g.* :—

Sleeping on sentry duty ...	... 2 to 6	months' imprisonment.
Refusing to obey an order ...	... 1 to 2	years' ,,
Striking his superior officer ...	... 5 to 10	years' ,,

General Langlois has proposed an amendment retaining courts-martial and constituting a corps of military legal advisors.

November, 1909.

A short digest is given of the Japanese Field Service Regulations, 1907.

Military Intelligence.—*France.*—Telephonic apparatus for infantry regiments. A certain number of infantry regiments who took part in the last grand manœuvres were supplied with portable field telephone apparatus. This was carried in three wallets on the waistbelt, one containing the cell, another the apparatus and spare microphones, and the third a reel of wire 1 kilometre long; the latter could be unrolled either by being held in the hand or by fixing on to the wallet. The apparatus was of the existing pattern, microphone and receiver on the same holder. The wire being extremely cheap, it will be unnecessary to pick it up again in the field, as this was found impracticable to do in the late war. It is laid most simply; an iron rod, with a hook at the end, fits into the end of the rifle, and allows of the wire being hung some distance above the ground, on trees, posts, etc.

'E.R.'

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MITTEILUNGEN ÜBER GEGENSTÄNDE DES ARTILLERIE-UND GENIEWESENS.

October, 1909.

A COMPARISON BETWEEN THE EFFICIENCY OF INFANTRY AND ARTILLERY FIRE, BASED ON THE RESULTS OF THE RUSSO-JAPANESE WAR.—There has latterly been a good deal of complaint that artillery fire is far behind rifle fire in efficiency, the reason being that in the last war only 7 per cent. of the losses were due to artillery and 93 per cent. to infantry.

The following is an attempt to eradicate the false impression which has been produced.

From trustworthy documentary evidence, it is known that the percentages of deaths and wounds due to the different weapons were as follows:—

Caused by rifle fire	86 per cent.
Caused by artillery fire	11 ,,
Caused by cold steel	3 ,,

Thus, as in the Russian Army the proportion of guns to men was three guns to 1,000 men, from the table above, the proportion of the losses due to these two forces is 11:86.

To obtain a fair comparison, we must compare the results obtained by a battery firing for a definite space of time, say one minute, with those of an infantry firing line whose length is the same as that of a battery in fighting formation, also firing for one minute.

The extent of front occupied by three guns is about 50 paces, and the maximum number of men that can be got into a front of that length is 50. It must also be remembered that the efficiency of artillery fire at a range of 3 kilometres is about equal to that of infantry at 1 kilometre, and that at 500 metres they are about equally effective. From the above it follows that if 50 men and 3 guns were allowed to fire at a target of men at a range of 500 metres for one minute, the losses due to each of these two units would be equal. Now the proportion 11:86 is based on the fact that there were 3 guns to 1,000 men; so to make our comparison fair we must find the proportion of losses due to 3 guns and 1,000 men, both firing as hard as they can at 500 metres. This proportion is obviously 1:20, for 3 guns are equal to 50 men—or 4·3:86!

Therefore in the Russo-Japanese War the artillery was 11/4·3, *i.e.*, $2\frac{1}{2}$ times as efficient as it might have theoretically been expected to be! Moreover it must be remembered that the artillery has always to fight the hostile artillery before the battle begins, that is to say, a target which does not offer nearly as many living objects as an infantry target.

From the above it will be seen what an extremely powerful weapon higher commanders have at their disposal in their artillery if only they use it properly; to do so however a clear idea of its fire efficiency is absolutely necessary.

THE PREVENTION OF MALARIA.—It is well known nowadays that certain diseases, malaria amongst others, are transmitted to the human body by means of microbes. Hitherto the means of fighting malaria have been

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either mechanical (the use of mosquito nets, masks, etc.), or internal remedies (such as quinine), or, finally, by the destruction of the insects by pouring petroleum on the marshes they inhabit.

Mr. Hartmann of Wiesbaden now suggests a new means, viz., to plant a type of fern on the surface of the water, thereby preventing the insects from laying their eggs on the surface of the water, and also preventing those hatched larvæ which are already in the water from coming to the surface.

NEW FIELD SEARCHLIGHTS FOR THE GERMAN ARMY.—The result of several experiments with searchlights mounted on motor cars has been so satisfactory, that the German Government has decided to get some for use in the field. The first one built has a strength of 25,000-C.P. and is driven by a 10-H.P. motor; the reflector is so made as to obtain a very long range.

REORGANIZATION OF THE GERMAN ENGINEERS.—The "General Inspection of the Engineer and Pioneer Corps and for Fortifications" is at Berlin, and has under it:—(*a*), Four Engineer Inspections, of which two are at Berlin, one at Strasburg, and one at Metz; (*b*), the Engineer Committee, which has four sections, all of which are at Berlin; (*c*), four Pioneer Inspections, of which one is at Berlin, one at Mainz, one at Magdeburg, and one at Dresden for the Saxon Army; (*d*), the Fortification School at Charlottenburg; (*e*), the Constructional School at Strasburg.

The *Pioneers* consist of:—The Pioneer Battalion of the Guard at Berlin, with 4 companies and 1 experimental company; and 24 pioneer battalions at different stations all over the Empire.

The *Line of Communication Troops* (*Verkehrstruppen*) consist of:—(*a*), The Line of Communication Troops Inspection, under which is the Railway Brigade of 3 regiments. There are 2 battalions to each regiment and 4 companies to each battalion. Two companies of the 2nd Regiment belong to the Saxon Army. The rest are all at Berlin.

To the Railway Brigade are also attached the depôt of the Railway Battalion at Berlin; the Berlin-Juterborg military line, which is 70 kilometres long, and entirely under military direction; and the Traffic Section at Berlin, with a small detachment in Saxony.

(*b*). The Field Telegraph Inspection at Berlin, which controls 4 telegraph battalions of 4 companies each, stationed at Berlin, Franckfort on the Oder, Coblentz, and Karlsruhe. Three companies of the 1st Battalion belong to the Saxon Army, and a detachment of another company is garrisoned in Wurtemberg. To the 1st Battalion are also attached a wireless section and the Cavalry Telegraph School in Berlin, and to each telegraph battalion is attached a detachment of "train" (A.S.C.) drivers, with their horses, for horsing the wagons in the field.

(*c*). The Airship Battalion, of 3 companies, stationed at Berlin.

(*d*). The Experimental Department, consisting of 1 experimental company and an automobile brigade of 2 automobile companies.

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The Inspection of Fortifications and of the Corps of Engineers of the Royal Bavarian Army is at Munich, and has under it, the 1st and 2nd Pioneer Battalions at Ingolstadt and Speyer, each consisting of 4 companies, and the 3rd Pioneer Battalion at Munich, consisting of 3 companies; the Railway Battalion, with an automobile section, at Munich; the Telegraph Detachment, 2 companies and a wireless section; the Cavalry Telegraph School at Munich; the Airship Detachment at Munich.

NEW FRENCH MACHINE GUNS.—The 11th Division at Nancy has been recently equipped with the improved model of the Puteaux Mitrailleuse; the other troops on the eastern French frontier still have only Hotchkiss machine guns. The Puteaux Firm have to deliver 4,000 machine guns with 6,000 rounds of ammunition per gun in six months. The full allowance is to be 434,000 rounds per gun. Each infantry regiment will be armed with 4 guns (2 sections of 2 guns), the guns being carried on pack animals. Each rifle battalion will have a mounted machine gun detachment. This detachment will consist of 2 machine guns, 2 wagons to carry their equipment and 49,000 cartridges, 1 officer, 24 men, 1 riding horse, and 9 draught horses.

A NEW SWISS RIFLE FOR NEW AMMUNITION.—At present the Swiss Army is equipped with the M89/92 rifle, which has a calibre of 7·5 millimetres, and fires a projectile weighing 13 grammes. The initial velocity is 600 metres per second, and the rifling consists of only three grooves. This weapon does not come up either to the French one firing the D cartridge, or to the German one using the S. It is therefore intended in Switzerland to construct a new rifle and a new cartridge which will surpass both the above-named sorts of ammunition. It is known that up to a range of 750 metres the trajectory of the German projectile is the flatter of the two, but that after that range the French projectile is the better one to use. The reason of this is that the German bullet is 10 grammes lighter than the French one; its initial velocity is 880 metres per second as opposed to the French 720 metres per second.

The new Swiss bullet is to have an initial velocity of 815 metres per second. The following table gives the dangerous space, at three different ranges, for a target 1 metre high:—

Projectile.	At 500 m.	At 1,000 m.	At 1,500 m. p.c.
German S	146 m.	29 m.	10 m.
French D	132 m.	36 m.	16 m.
New Swiss	185 m.	53 m.	29 m.

The new Swiss rifle is to weigh only 4·5 kilogrammes, *i.e.*, 300 grammes less than the one now in use; its calibre is to remain as at present, 7·5 millimetres, and the magazine will hold six rounds.

A. H. SCOTT.

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Revue du Génie Militaire.

October, 1909.

The Flight of Birds.—The writer shows, by mathematical calculations, that a bird or aeroplane which flaps its wings will remain in the air longer than one that merely glides. These calculations do not assume the existence of any valves in the wings. In the same way, a floating plank that has not sufficient buoyancy to support the weight of a man will nevertheless support him if he dances upon it instead of standing still.—*To be continued.*

The Organization of Mines in a Fortress.—This article begins with a description of the Russian countermines at Port Arthur, taken from the *Eenzhenernee Zhoornal*. No work had been done before the commencement of the siege. If any system of countermines had been designed, it was not available, as all the plans of Port Arthur were with Kuropatkin's field army. The Russian engineers were unwilling to commence any countermines, as they believed that the fate of the fortress would be decided before the galleries could be driven to any effective distance. Finally, when a beginning was made, the Japanese had driven their saps and mines too close up to the forts for the countermines to cause them any serious delay.

At Kikwan North Fort the Russians began two countermine galleries. Through some miscalculation one of these came to the surface of the glacis a short distance from the crest. To remedy this, a shaft about 14′ deep was sunk a little distance back and another gallery was started. When it was estimated that the Japanese gallery had come within about a yard of the Russian gallery, the countermine was charged with 80 kilogrammes of powder and fired. The Japanese gallery was destroyed, but the explosion also laid bare the concrete roof of the counterscarp gallery. The Japanese at once established themselves in the crater, breached the counterscarp gallery, and drove the Russians out of it. The other countermine gallery at Kikwan North did not come sufficiently near the Japanese gallery to be used effectively. This countermine was charged and fired four times. On the first occasion it failed to damage the Japanese in any way. The second charge destroyed part of the counterscarp gallery wall, the third did considerable damage to the Japanese saps, but the fourth destroyed the counterscarp wall altogether. A certain amount of countermining was done at Hatchimaki, Ehrlong, and Long-shu-shan, but none of these mines were charged or fired.—*To be continued.*

J. E. E. Crastfr.

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CORRESPONDENCE.

TENSION BRIDGE.

DEAR SIR,

Owing to Capt. Mozley's article on a proposed tension bridge in *R.E. Journal* of May, 1909, a bridge of this type was made in Bangalore. I think it presented few advantages over the ordinary type of suspension bridge. The span was 159′, and there were 9 transoms. Ties made of telegraph wire; breaking strain, 2,000 lbs.

I will take the advantages claimed by Capt. Mozley for this tension bridge in order.

CAPT. MOZLEY.	
1. Elimination of vertical oscillation, etc.	1. Yes.
2. ,, liability of bridge to collapse suddenly, etc.	2. Yes.
3. No large cables involved. This is a matter of importance, as they are rarely available on service.	3. If sufficient wire is available to make a tension bridge, there is also sufficient to make cables for a suspension bridge.
4. Distinct saving of time, etc.	4. The bridge took me longer to construct. Each tie consisted of 3—7 wires; the extra time required to join these up into a cable is not great. Putting two cables over a frame, making four anchorage fastenings, and 18 fastenings on cables for transoms took less time than putting 18 ties over a frame and making 36 anchorage fastenings.
5. Simplicity and speed of adjustment, etc.	5. I find it a great deal easier and quicker to windlass up the transom of a suspension bridge than it is to raise the transom of a tension bridge by taking in the ties at the anchorages.
	6. The necessity of high piers in a tension bridge is a disadvantage
	7. The ties seemed to stretch more than cable. I twice loaded the bridge, and each time had to readjust nearly the whole of the transoms; a lengthy operation.
	8. The same company made a bridge of this type in Sikkim. The only advantage found was stiffness.

J. R. WHITE,
Capt., R.E.

The Editor, *R.E. Journal.*

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3.—Yunnan Pack Saddle.

The Saddle before Trestle is fitted to it.

4.—Yunnan Pack Saddle.

Fitting Loaded Trestle on to Saddle.

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The Posi Bridge from the South-West.

The East Gate of the Posi Bridge.

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CONTRIVANCES OF MILITARY INTEREST IN YUNNAN.

THE following notes are communicated as being likely to prove of military interest. They comprise details of an old bridge at Posi, of a Yunnanese water wheel, and finally of a Yunnan bullock cart and pack saddle. The pack saddle, as described, is common in China, being also met with in Shantung and Chihli and most probably in many other of the Provinces.

1.—THE BRIDGE AT POSI.

Principle of Construction.—The bridge is a combined cantilever and suspension bridge, built in the following manner :—

Two cantilevers, similar to the military cantilever bridge, are built out from either bank with logs, which are, moreover, strengthened by joining them together with wooden trenails. On the inner ends of these logs, instead of heaping large boulders, the foundations of the towers are built. These towers support the eight chains, four on each side, which in their turn support the centre portion of the bridge. The general idea can be seen from the accompanying rough sketch (*Fig.* 1).

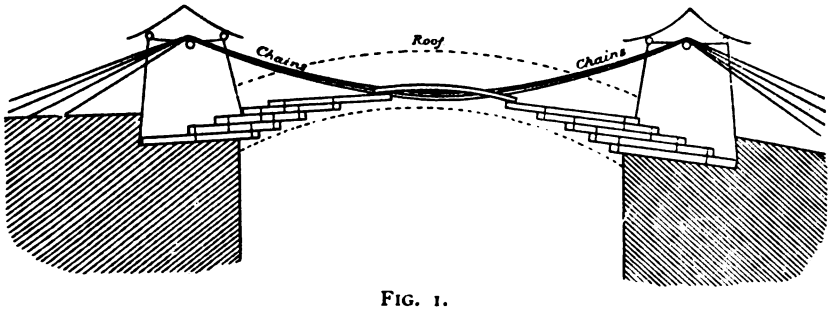

FIG. 1.

It seems that a bridge of this type should give a very considerable span, for two reasons :—

(1). The weight on the inner ends of the cantilevers is very considerably more than that of the ordinary field type of cantilever bridge.

(2). The load on the bridge is compensating, *i.e.* the greater the load on the centre of the bridge, the greater the downward thrust on the towers due to the chains and therefore on the inner ends of the cantilevers.

Finally the span of the Posi Bridge is about 300′, and there is a considerable mule caravan traffic across it.

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2.—THE YUNNANESE WATER WHEEL.

These wheels are used for driving the rice mills and are of two distinct types :—

(1). A small diameter wheel with deep paddles for driving the husking mill. This revolves at a fairly high speed.

(2). A large diameter wheel for driving the hulling mill. This gives rather more power but revolves more slowly.

The principle on which these two ancient mechanical contrivances are based is the same in both cases, and is nothing more or less than the principle of the modern water turbine. The wheel pit is under the floor of the mill, and the wheel revolves on a vertical spindle with the paddles touching the water in the pit.

The paddles round the circumference are about 8″ to 1′ wide, and from 1′ to 14″ deep. They are made in two parts. The upper part is almost vertical, whereas the lower part is set at an angle of about 45° (*Fig.* 2).

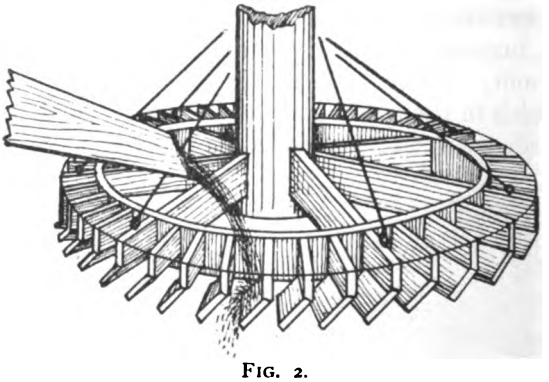

FIG. 2.

The mill is driven by a fall of water from a wooden chute the width of the paddles, and set about 3′ above the wheel. Speeds can be altered to a small extent by lowering or raising the end of the chute which alters the angle of incidence of the stream of water.

The damming arrangements are very simple. The mill is placed above the flood level of the river.

Water is led from a point higher up the river in a wooden trough (A) to a sort of reservoir (B) (*Fig.* 3) in which it is maintained at a height of 3′ to 4′ above the wheel, by means of weirs.

Three sluice gates serve the following purposes :—No. 1 leads to the mill-wheel chute, No. 2 serves to empty the wheel pit (*c*), when necessary, and No. 3 empties the reservoir if required.

This idea might serve in a standing camp near a suitable river for driving chaff cutters, etc., as it is much easier to put up and control than the old European water wheel, and uses less water.

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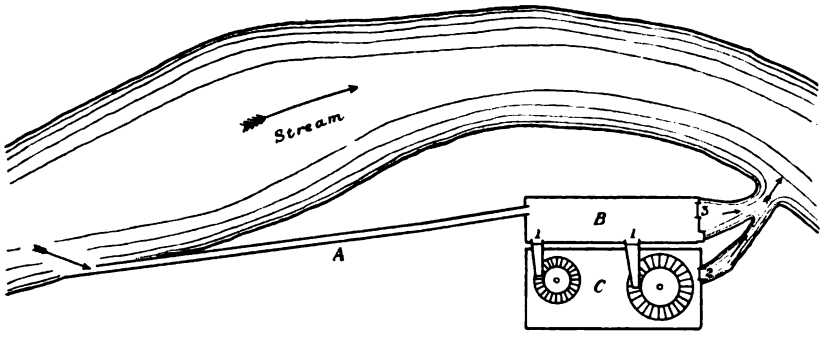

FIG. 3.

3.—VARIOUS MEANS OF TRANSPORT.

(*a*). *The Yunnan Bullock Cart.*—The wheels and axle are solid, and revolve together. The bearings of the axle are two wooden forks.

The cart can be lifted off the wheels and replaced in the event of an accident. The harness consists of the yoke, the yoke line under the neck, and a light breeching. Load about 500 lbs.

(*b*). *The Yunnan Pack Saddles.*—The saddle is of wood and is padded inside. It is retained on the mule's back by means of a breast strap and breeching. The crupper is of wood, threaded on a piece of gut or raw hide. A series of wooden discs or rollers on the crupper, prevent chafing on the animal's back. A triangular pad of cloth, fastened to the breeching on each side, goes over the root of the tail and under the crupper, presumably to prevent chafing. There are no girths (see *Photo* 3). Into the saddle fits a sort of wooden trestle as shown in *Fig.* 4.

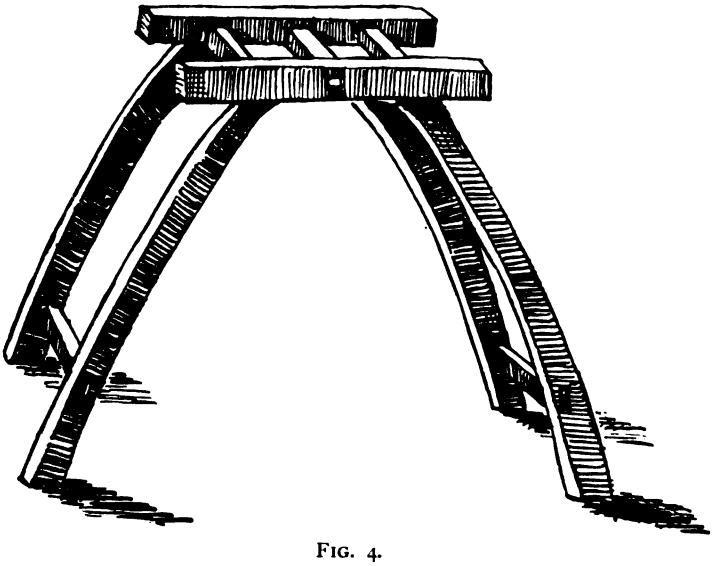

FIG. 4.

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The trestle is placed on the ground and the packs lashed to it with raw-hide thongs. The Chinese grooms, in this case muleteers, make some very clever tightening hitches. Two men, one on each side, then lift the trestle and pack off the ground holding it by the feet of the trestle, and fit it into its place on the saddle, while a third holds the animal's head (see *Photo* 4). As soon as the animal is released he takes his place in the caravan of his own accord.

These mules and ponies carry from 140 lbs. to 180 lbs. for long journeys. The latter load is however, unusually heavy for the ordinary animal.

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GENERAL PRINCIPLES OF ORGANIZATION AND EQUIPMENT, ROYAL ENGINEERS.

(*Continued*).

29TH COMPANY (WORKS COMPANY).

The peace station of this unit, which forms part of the Expeditionary Force, is Chatham.

Its establishment is based on the provision of :—

*(*a*). An advanced works depôt at each of two advanced bases.

(*b*). A headquarters including a small base depôt.

(*c*). A works depôt and workshop at railhead.

Such transport as may be required will be furnished under the orders of the Inspector-General of Communications.

Officers and civilian labour will be added as required.

The establishment of this company consists of :—

	Peace.	War.
Officers	2	7
Sergeants and Staff-Sergeants	4	18
Buglers	2	2
Rank and File	54	140

The machinery necessary for the installation of a workshop, together with other stores for the depôts, is maintained by this company in peace.

FORTRESS COMPANIES.

These may be divided under two headings—the Fortress Company Proper, and the Electric Light Companies which are the direct descendants of the old submarine mining companies. Both, though, are officially designated Fortress Companies.

The former are organized specially for work connected with the construction, attack, and defence of fortresses.

In time of peace these companies are employed in executing War Department civil work, in the construction and repair of buildings, barracks, works, and so forth.

The average strength of a fortress company in peace varies from 3·86 officers and 76·4 men at home† to 4 officers and 96·6 men abroad.

* "War Establishments, 1909–10."

† From "Regimental Establishments, 1909–10."

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There is practically no established equipment detailed for peace or war. It is supposed that special demands for tools, etc., would be made according to the work on which the company was to be employed.

The electric light units are organized to assist in the defence of military ports at home and abroad, commercial ports at home and coaling stations abroad. The requirements of each station, based on its scheme of defence, have been definitely determined.

The details of *personnel* for each station can be found in "Regimental Establishments." Details of trades are given in Corps Memos. At home, on the outbreak of hostilities, the establishments are brought up to war strength by the addition of Territorials, Special Reserves, etc. Abroad there is but one establishment of *personnel* and stores, viz., that for war requirements.

There are two schools of electric lighting, viz., at Portsmouth and Plymouth. It is not considered necessary to detail what instruction is carried out at each school, but it may be mentioned that R.E. recruits for electric lighting proceed from the R.E. Depôt, Chatham, after training in drill and fieldworks, to these two schools. Each of the electric light companies is affiliated for purposes of supply of men, etc., to one or other of the two schools.

SURVEY COMPANIES.

There are three Survey Companies, with their headquarters at Southampton, York, and Dublin, respectively. The number of Royal Engineers at present employed on the Ordnance Survey of the United Kingdom is 21 officers and 326 W.O., N.C. officers and men. The establishment of the three survey companies is 8 officers and 342 W.O., N.C.O.'s and men. The majority of the employés on the Ordnance Survey are civilians, who work under the R.E. officers and with the men.

The country is divided into divisions for survey purposes, and to each division is attached a proportion of men of the Corps. All maps are printed and published at Southampton and Dublin. Endeavours are made that the R.E. employed on survey work shall become efficient in all branches of the several processes, so that on service they may be able to put their hands to any of them as may be required, or that detachments may be made up to undertake the survey of any new country where operations may be going on.

On a general mobilization being ordered, the Survey Companies provide certain survey *personnel* for lithographic sections and for field and railway companies. Survey sections may be required with, but do not normally form part of, the Expeditionary Force. These sections if required would be provided from the Survey Companies. The equipment for a survey section for war is given in the Mobiliza-

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tion Store Table for the Section (Army Form G 1098–40). Two survey companies also mobilize as fortress companies with a peace strength as specially arranged. The remainder of the survey companies are retained on Ordnance Survey duties for any special work that the War Office may require.

Colonial Survey Section.

A Colonial Survey Section, with an establishment of two officers and four other ranks, was formed in 1902. The men are provided by the survey companies.

In addition, a number of N.C.O.'s and men of the survey companies are lent to the Colonial Office for employment on Colonial surveys.

The officers and men of the survey companies are paid by the Board of Agriculture and Fisheries, except during military training, or on mobilization.

DEPÔT BATTALION.

The Depôt Battalion, permanently stationed at Chatham, is organized in three companies, lettered G, L, and M, and the 29th (Works) Company is attached to it for purposes of discipline.

G Company includes all men on command at various institutions and employments who are not posted to service companies, or on the Supernumerary List. It is also the receiving company for casuals from abroad, on furlough, awaiting discharge, etc., etc. On mobilization, G Company is a receiving company for Reservists joining at Chatham.

L Company includes the Band and S.M.E. Staff.

M Company takes all N.C. officers and men coming to Chatham for courses at the S.M.E. It is also on mobilization a receiving company for Reservists joining at Chatham.

TRAINING BATTALION, R.E.

The battalion, consisting of six companies, lettered A to F, is stationed at Chatham, and exists for the following purposes, namely :—

(i.). The training of all Sapper recruits of the Corps, except those for field troops, in

(*a*). Military duties.

(*b*). Fieldworks.

(ii.). Training of all junior officers of the Corps on first joining in military duties.

Organization of Recruit Parties.—The company forms the training unit in the battalion. Each company receives recruits for a period not exceeding a month, or until a recruit party of about 64, and in some cases 80, has been formed. Each party is trained separately; the full course, lasting about 28 weeks, is divided into the drill course,

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which includes physical training, musketry course, and fieldworks course.

Military Training of Junior Officers.—The course of instruction is in duties, drill, and tactics; it is given in two periods. The first period lasts for 83 days, commencing as each batch of junior officers joins at the S.M.E. The second period lasts 21 days, and includes the examination in subjects (a_1) and (a_2) for promotion.

Officers of the Royal Reserve Engineers also go through a course of military training on joining the S.M.E.

TRAINING DEPÔT FOR FIELD UNITS.

The Training Depôt is stationed at Aldershot, and is under the orders of the Officer Commanding the Royal Engineers Troops and Companies. Its duties are the training of the drivers, mounted sappers of field troops, and trumpeters of the Corps.

Its peace establishment, which includes the mounted cadres of two Bridging Trains, is :—

Officers	4
Warrant Officers, Non-Commissioned Officers and Men ...	262
Horses, Riding	40
„ Draught	36

ROYAL ENGINEERS IN INDIA.

The officers of the Corps serving in India belong to the Regimental Establishment, but their duties are entirely distinct from those serving at home or in the Colonies. Under the present pension rules, a higher rate of pension can be gained under certain conditions after 20 years' service in India. There are only very few European R.E. rank and file in India. The officers are employed in various Staff appointments, on the Military Works Services, in the Public Works Department, on the Survey of India, on railway work and other civil employments, in all of which they have civil labour under them. They may be also attached to the native Sappers and Miners, of which there are three corps. There are also two Indian Railway Companies, with headquarters at Sialkote, and three Submarine Mining Companies, with additional sections at Calcutta and Aden, and headquarters at Simla. The companies of the Sappers and Miners correspond to, and have the same functions as, the field companies at home, but their organization and equipment are different, and are specially designed to meet the requirements of the country.

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MOBILIZATION IN THE 16th CENTURY.

EVEN the minutest detail of mobilization is so carefully worked out and tested in the present day, that a glimpse at the rough-and-ready methods of the 16th century is sure to prove of interest to the soldier. The manuscript, from which the following extracts are taken, has long been in the family of Mr. J. Coventry of Fordingbridge and apparently refers to the preparations made in Hampshire in 1553 to crush the rebellion under Sir Thomas Wyatt, and also to a later scheme for protecting the coast against an expected invasion in 1563.

As the manuscript refers to events which took place some 20 years only before the Armada, special interest attaches to it, as the mobilization of the men of the Southern Counties to meet the dreaded invasion was most probably carried out on exactly the same lines.

The abbreviations and spelling are unchanged from the original, but the detailed lists of the leaders, and the number of men to be provided by each hundred are omitted for want of space.

Finally, crude as the methods may appear to the soldier of the 20th century, they apparently served their purpose in the 16th. Mobilization in those days was a much easier task, as not only were most Englishmen well able to handle the simple weapons of the period, but the patriotism of the masses and their inborn sense of discipline, enabled their leaders to order whatever seemed best, with the certainty of their orders being carried out with unquestioning obedience.

MANUSCRIPTS ON THE DEFENCE OF THE ISLE OF WIGHT AND PORTSMOUTH.

(1).

(Letter from Lord Poulet to Lord Seint John).

After harty commendacions my lorde forgettyng to wryt thereof to you wyllyth me to wryte to you that the lord of Pembrok as levetenaunt generall dothe folow the rebels wher so euer they goe and my lorde with all hys power if they com in to Hampshire wyll com also with hys bande. my lorde hath wryte to you at length hys mynde and hath wylled me also to wryte you my mynde & therfor my poure advyce is this.

Furst to call all the gentylmen of the devysions adyoning the Sey costes & cause them to putt themself with the pouer of ther Quarters

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to deffend Portesmouth with the Fortes Hampton & the fortes ther aboutes & wher harnesys be knowen as at Tycheffeld & such other places to geve order for suertye of hyt that hyt may serve if nede be. And by cause the Eretykes of the shire begynnith to Flocke to geders specyaly in the towne of Hampton, about Romesey & dyuers other places of the Shire you had nede to wryte to Mr Pacy for Hampton & to others that you know trusty to loke to ther doinges and yf they be gyne togader to call to you ther leaders & geve order for ther safftye for the tyme.

In the towne of Hampton by Mr Pacys Report ben knyt now togeder the Mayre with iiij mo heddes of the towne, yong Mr Lyster Seint John & dyvers other whiche now besely mete togeder very necessary to be considered. About Romsey is Foster Flemynges offycers, Gyfford, Baynbryg Harrys and Whytthedd & Dyuers other that now consultyth moche togeder.

Kepe sure you entre into the Ille of Portesmuth for that he wyll desire yf he may.

And Remembre well what I seiyd you of the prevy messangers that come to Hampton iij tymes in on month only to the Mayre & Bokyngham for Fere of treasons wherof Renegai can make you prevy.

I wryte to the Shryff & the Rest of the Shire to putt them selfes with all ther powers in Redynes of warde with all spede for defens of the Countre yf they com this way wherof you shal vnderstande shortly and so till furder knowlege so fare ye well.

Wryten this* Day of Febuary

yo vncle

GEORGE POULET.

I sende you herwith my letter wherof I wryte the lyke to al the devysions of the Shire except the devisions vnderwryten to whom I pray you to wryte lyke letters & putt therto my namand† wryte yo'self yo' lyke letters to them that they ben in Redynes to attende with you at Portesmuth & thus ye shall put that quarter in Redynes as I wyll do with the Shreffes help the Rest.

My letters to John Whyt for his devision
To the Mayre for the towne of Southampton
to the Ile of Wight.

Thes iij letters I pray you sende with spede from me besides your owne letters.

To the right honorable the
Lorde Seint John with spede.
Hast.
Hast.

* Blank in MS.

† Apparently for "name and," in haste the two words being run together.

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(2).

(*Letter from R. Wyngfeld to Lord Seint John*).

Right honorabull and my verie good Lorde my humble deutie considered pleasith y^r^ lordshipe to be aduertised that I haue sene the Estate of the towne of Portisemouth the castelles bulle workes walles and dyches of the same w^th^ all the peces shotte powder and all other artilerie and abelimentes For the warres wiche I fynde in good order savinge the Fortes wiche is in sore decaye, And the peopyll well ordered and in good quietnes. And for soo moche as S^r^ Richard Cotten is at Callyce and Rauffe Cotten his brother *brother* (*sic*, twice) Remayning at London M^r^ Wayte being not abull to travell there is none in that devision lefte but M^r^ Whyte and M^r^ Pound. Whereffore it is Requisite the premisses considered there maye be moo appoynted to theym as Sir John Broyne Thomas Vuedall and William Vuedall of Wykeham who is left oute of the same devision. And if the hundreth of Tycheffeld be appoynted to Haysylworth as your Instruccions is then there muste be ane other hundreth placed in the same to Portesmouth. And this present daye I doe intend to goo into the Isle of Wight, and at my Retorne I shall serteffie your Lordship of the Estate of all the same w^th^ the Rest in my charge by yo^r^ Lordship's instruccions by a perffite book wiche for lake of tyme I cane not now doo. Thus our Lord send your Lordship large (?) help.

At viij of the clokk this messenger aryved here w^th^ lettres directed unto yo^r^ Lordship, sainge he was willed to delyuer theim to Jhon Chuddeston, they commyng fyrst to my handes seinge the were yo^r^ Lordships, I dyd forthwith cause one assone as the tyde wold serue to come to yo^r^ Lordship with theim, in w^ch^ lettres I praye god send yo^r^ Lordship newis such as you wold desyre. From Portysmouthe the vij^e^ of februarj 1553.

Yo Lordships to command
R. WYNGFELD.

To the right honorable
and my singular good
Lorde, my Lord Seint Jhon.
On
Hast
Hast.

(3).

(*Letter from the Marquis of Winchester to Lord Seint John*).

For annser to yo^r^ lettre w^ch^ I receyved this tursday I lyke well that you Find all thinges well at Portismough & that quarter & that now you mynde to goo to the Ile of Wight to se all thinges ther w^ch^ I prey you do. First by yo^r^ seruaunt & then yo^r^ self at Portysmough to performe this that I writt to you in this lettre.

You shall vndrestand that this day x at clok in the fore none Wyat & his company departed from London towardes Kingston or to

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Rochester the certenty wherof doth not appere. And therefore my Lordes willeth me to se well to Portismough & to the Ile of Wight Willing you to warne Winkfeld & all that quarter to make theym Redy lest he shuld draw to you warde.

And cause Portbredge to be furnisshed & euery castells. And wher nede shall requyr plant ordynance and truche that you may if you lerne he come towardes you.

I perceyve the bruhouses & bakehouses be well apt, wherof I am gladd.

And for yo^{r} helpe cause all the Commissioners to be warned to attend wth all the poure they can make to defend Portismough & the Ile of Wight.

And geve order to theym appointed to the Ile to be redy to defend the same & to enter [? Quarter] at the Castell of the Hurst purposely for that purpose.

And be not yo^{r} self out of Portismough til you be certen what he wyll do. And for yo^{r} certen knolege therupon I cause one to folow hym to se wher he will become that you may be certen to stand the more surely apon yo^{r} gard, & to voyde troble & charge but where nede ys.

And yf the hundredes named to you be not sufficient wherof I do not a lytill marvel for that I have all years (?) found them sufficient, yet my mynd is you take as many mo hundredes to you as you shall think mete. And bring not to many to you for any fere but for nede when you shall se tyme. And so take all the Sheire for that purpose.

iiij or vj men in the castill of Hasillworth is I now to wacthe the same & to geve warnyng for the hundred to helpe if nede be & all the rest may tende Portismough.

And my bruder Sir George Poulett will apon the reding of this lettre geve order to all the rest of the Shere to be redy if the case shall so requyr.

And order must be taken that you may kno certenly his Jorney & purpose to make his Jorney towardes you or somme oder way in whom ys no suerty for that he is a verry desperatt man.

And like as I make serche to kno his Jorney so must yo^{r} vncle & you apply to kno what Jorney he taketh that you may the mor surly defend yo^{r} selfis and the cuntrey.

And taking a copy of this lettre send the same, my lettre unto the Ile of Wight wherby they wilbe the more diligent to defend the quenez highnes & theym selfis. Wretin this Shrof tursday in hast by yo^{r} fader.

WINCHESTER.

And if any charge fall apon your quarter as I trust in God yt sall no. Then must euery hundred be named to send mete & drinke for ther men for xij days as yt hath byn done afore this tyme.

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And his comyng towardes you must be by Fernham (?) & so to Aulton or else ouer Kingston bridge & so to Besingstoke & to you & that I think he cannot do for Kingston bridge is broken.

And if you perceyve of his comyng take hede towardes you take hede for he will make gret hast.

And the ordynance you have to mount you may cause yt to be done as you se cause or else Spare.

My Lord of Winchester will se the devyne service ther said the lett therof is in the governours of the towne.

To my son the lord
Seint John.
WINCHESTER.

Here follow lists of the "ablemen" to be provided by the various towns and villages. Only one of these is given, but all are on the same model.

Thornegate	Edward Harries Brian Fantleroy Robert Caitterton Humfrey Barqueley	ablemen cc.
Buttilsgate	James Ritche Bartilmew Dove William Hall Jo. Bacon	ablemen cc.
Sombourne	Ric. Gifford Hen. Walley Jo. Douse Robert Pister	ablemen clx.
Forthingbride Ringewood	Edwerd Abarrowe Sr. Wm. (?) Kellewey Phillip Okeden	ablemen ciiij^{xx}
City of Winton & the Soke	xxx Maior of citie of Winton xxij Bailif of the Soke	ablemen lij.
Barton Stacy	Thomas Salmon Tho. Chandlour	ablemen lxxij.
Micheldevour	Ed. Clerke Robert Stansbie	ablemen lxxviij.
Redbridge	Robert Baymant Jo. Jeynynges Wm. Hoker	ablemen lxiij.
	Sum—M^{l}.V.	

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The whole are detailed as follows :—

Apointed for the Coast betwene Boremouth & Hampton	Summa	iiii^{c}xlviij
"Southt" ... ... ablemen ...	...	iii^{c}iiii^{xx}
Apointed for Portesmouthe	Summa	M^{l}cxxii
Portesmouth ... ... ablemen ...	...	Cxlviij
Yle of Wight ... ... ablemen ...	...	M^{l}D
Apointed for the bodie of the shire ...	Summa	M^{l}ij^{c}iiii^{xx}iii

(4).

An order as well for the Armour of all Captaynes as shalbe appointed to serve the Quenes M^{tie} at this tyme as allso for all Souldiours that shalbe appointed for the like service.

Furst if it be possible to make any nomber of demi Launces (as I suppose there wilbe butt few) then the Captayne of theym and Souldiours also must be well armed at all pointes accordingly, that is to saye his Colo^{r} his Curettes his Vambraces, his pollrons, his heddpece, his gauntlettes and his Cusshes, and the Capitayne to have his graunde garde & his graves more then the Souldiour & his horsse to be of xvij handfull height or ther about and the same to be trymmed wth a sele Saddell and a Shaffron. And the Souldiours to have horses of like height wth Bolster Saddells of blacke lether or Buffe, and euery man to have his demi Launce staffe.

There belongith allso to this kinde of service a Guydon of the Captaynes colours and a Trompett.

Item a Captayne of light Horsemen must be armed with a Jacke or Brygandyne covered wth vellvett or satten, and for his hedd a Sculle or Murryan for his Armes a pair of Sleves of Mayle and euery Souldiour to have Jackes covered wth fustian & Skullis with Scotishe cappes & for his Armes sleves of Mayle & euery man a light horsemans staff & their horses to be of small xv handfull height or there aboutes.

A Captayne of footemen must be armed wth a fair Coslett for his body a pair of Vambraces for his Armes & a morian for his head, with Swerd & dagger. & either a poll axe or els a glave to be caried after him by his page.

Item Harquebuttes must be armed in a shirte of Mayle for his body & a morian or huffekyn for his head and to have his pece of an elle longe at the lest or more, & to have his powder & matche wth all thinges accordingly.

Item all Archers must be armed in Brygondynes wth sleves of Mayle for their Armes & Skulles or morians for their heades & euery man to have his Bowe & his Sheaffe of Arrowes & for lacke of Brygondynes the said archers must have Alman revettes for their bodies wth splentes for their Armes.

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Item pyke men must be well armed in fair Coslettes white or blacke for all their bodie from the Mydde there vppewarde and vpon their heades Morians or huffekyns & euery man to have his pyke.

Item Bill men must be armed wth Alman revettes splintes & Sallettes & euery man to have his Bill.

This ends the correspondence dealing with the preparations in 1553. It is followed by a list of "Lordes & nobylle men taken by the Kinges Ma^{tie}" at St. Quentin in 1557, and this list, in its turn, is followed by further lists of "ablemen" in connection with the second mobilization of 1563.

The l. lordes & nobylle men taken by the Kinges Ma^{tie} the ix of August 1557 at S^{t} Quyntyns.

In primis the heigh Constabull of Fraunce and his second sonne.
Item the Duke of Montpensere.
Item the Duke of Longvyle.
Item the prince of Mantua.
Item the prince of Rocha de Vynyard.
Item the Vicounte Cothon.
Item the great Chamberlayne of Fraunce.
Item the Vicounte of Toben.
Item the Ringrave Capitayne generall of xij$^{M^{l}}$ heigh duchemen.
Item Laroche de bew a son in law to the high Constabull.
Item prisoners taken to the nomber of vj$^{M^{l}}$, whereof dyuers great men ouer and aboue thes beffore Rehersed.
Item taken xxxij^{te} peces of great ordenaunces.
Item taken vj^{c} wagons wth vitalles and munición.
The Capitayne of the towne of S^{t} Quyntyns did offer the Towne to the Kinges Ma^{tie} soo that he wold graunte theym there lyves with bagge and baggage.

(Indorsed) :—An order for armour and wepons and the names of the nobyll men taken at Seynt Qwyntyns.

The papers which follow are in connection with the preparations made in 1563. In 1560 Elizabeth had sent help to Condé, leader of the French Protestants, in their war with the Duke of Guise, and she was compelled in 1563, by the reduction of the garrison after the peace of Amboise, to surrender Havre, which, with Dieppe, had been the price of her support. As the letters are written in the same year, it seems fair to assume that the measures taken were directed against an expected invasion by the French.

The first document contains a detailed list of the "ablemen" available. Unfortunately it is too long to give in detail, but the final disposition of the forces is as follows :—

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M^{l}V..." For the Relif of the Isle of Weight."
M^{l}ccxxii..." For the Releif of Portismouthe."
Cxv..." Towne of Portismoth."
xxxiii..." The guyldable within the Isle."
Ccc..." The crew or garison there at the quenes ma^{tie} charges."
M DCLXX..." Totalis for Portismouth."
M D..." The Cap^{ne} & the gentlemen within the Isle—The Isle of Wyght."
Cccccxlviij..." Summa—For the Bodie of the Shire."
Ccciiii^{xx}.. "The Towne of Suthampton."

"Summa Totalis"—.vji^{xl}cciiii^{xx}vj.

Next follows "A booke of the names of suche as ar thoght most metest to be captaines or Leders of all the able men in every hundred within the Countie of South' as well to the releffe of the Isle of Wight and Portesmouth as also for the defence of the Boddie of the Sheere and the see Coste" which again goes through the detail of "Ablemen" provided by each "Hundred." Unfortunately this also is too long for publication, but the following letter from Lord St. John, containing a list of the boats available for transport purposes, is given in full :—

A° Elizabeth. vj^{to}.

Havinge receved the councelles lettres of great importaunce requiringe presente execucions as consultations with the captaines of
1563. Portismoth and Isle of Wight, this shalbe to requier you not onlie to cause your accustomed beacons to be errectid and watchid substanciallie butt also to send suche numbers of men to call short and Hurst as heretofore hathe ben assigned vnto them in all acacions of drede of forren enemyes. And for that the quenes ma^{ty} hathe no lesse care to defend thisles of Weight and Portismoth than she hathe ben heretofore, her ma^{tie} pleasure is the botes shulbe put in a redines for transportacions in to the said Isle as nede shall requier, and the same presentelie must be don vppon sight hereof. And for that I doubt whether the number of the said boates be increased or diminished, you shall receave a note herein closed of the last certificat of them w^{ch} I praye you make perfyt the number of boates with the names of thoners and his retinewe and what number euery bote maie transport at one time. And I praye you note your passage botes and charge them to geve attendaunce and not to depart for aine seruice other then the quenes and tak order with your country to be in a redines for service and to repaire to deffend thenimyes and saffegard of the quenes fortis as occasion shalbe geven, for which matre victualles muste be put in aredines. And for thes causes I wisshe yourselves would repaire at suche place and time as shalbe geven forder in knouledge vnto you, when I shall here from the Captaines of Weight

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and Portismoth, who be speciallie writen vnto as we be. Thus muche I geve you knowlege of presentlie to be put in execucion whereof I requier you not to faile, and for the ledinge of suche number as you shall make tak the same knightes and gentlemen which hath ben heretofore ascribed vnto you. And for the beter transportacions of your men and strenght of the quenes castell of Hurst tak likewise the same gentlemen, and what you shall do in the premisses I praye you to aduertise with speede that the wantes maie be supplied. Wryten in hast this xxvj of January,

Your frend,
JOHN ST. JOHN.

Of Heath.

Owner.	William Waie a bote iiij^{or} tunnes	Botes appointed to leape to transport men into thisle of Wight upon larum or fier contening xx^{ti} tunnes after x men to their tunn CC.
Owner.	Jefferey Ward a bote iiij^{or} tunnes Richard Ward mariner with him	
Owner.	John Holford a bote iiij tunnes John Holfurd his sonne mariner with him	
Owner.	John Hilles a bote iiij tunnes Thomas Skipp & Ric: West mariners in the same	
Owner.	Robert Gervys a bote iiij tunnes Edmint Wall mariner with him	

Botes of Leape.

Owner.	Hugh Mone a bote v tunnis.	iiij^{or} botes conteininge xvj tunnes.
Owner.	Thomas Goodier a bot iij tunnes Richard Alrige mariner with him	
	Thomas Cowper & Jerom Ingram a bote iiij tunnes and they two to serve the same	
Owner.	Thomas Hailes a bote iiij^{or} tunnes John Mone a mariner with him	

Botes of Gurnarde.

Owner.	Richard Cole a bote viij tunnes	ij botes conteininge xv tunnes.
Owner.	John Aly a bote of vij tunnes	

Summa Totalis of botis—xj conteininge lj tunnes which will convey over CCCCC men at a sodden.

Christchurch botes	...	vij	botes ... xxxv. tunnes ... cxl. burden after the rate of iiij^{xx} men to the tunne. v^{c}lx.
Kinhaven botes	...	iij	
Hurst botes ...	...	ij	
Lymington botes	...	iij	
Yermoth botes	...	ij	
Frenshwater botes	...	iij	
Leape botes ...	...	ij	
Farley botes ...	...	iij	
Heathe botes	...	vij	
Gurnarde botes	...	iij	

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I commend me hartelie vnto yow and have sent yow the names of suche hundreds as are appointted & charged for the Releffe of the Isle of Wight that is to saye Thornegate Buttelsgate Somebourne, Fordingbridge, Ringwood, Redbrydge, the Citie & Sooke of Winton, Bartonstacy and Mycheldevour of which Hundredes I praie yow make choise of the best & ablest men, and cawse them vppon euery alarum to be brought to the Sea Coste to be transported into the Isle of Wight w^th^ thear armour and weapons mete for this service and victuelles w^th^ victuallours to followe them and for Captens. I praie yow make choise of the best not onely of habilite but also of knowledge and experience to bringe the nomber that is appointted for the Wight to the place of service or to the places of transportinge and so ouer. Fare ye well at Letley this last of Januarie 1563.

Your loving frend,

JOHN S^T.^ JOHN.

Postscript. I find in the last orders that my Lord tresaurour tok for the Shire that Andevour infra et extra is not charged to thisle of Weight but to the body of the Shire And therfore it must stand and be charged for the body of the Shire.

The Councelles lettres to my Lorde Seint John.

After our verie hartie commendacions to your Lordeshippe like as vppon suche aduertisement as we formerlie receivede we wrote yesterdaie vnto yow of the preparacion of the french and therefore required you that the beacons on the see costes might be wached and the countrie neare the see costes put in a redines to meet with all sudden attemptes that might be offered, so havinge now forder intelligence of french shipps made to the sees and numbers of soldiers comme downe vnto pikerdy neere bullen and Callice Albeit that they make shewe to attempte sumwhat about Dover or the costes of Kente and Sussex, yet it is to be fearied that ther interprice is tende towardes Portismoth and thisle of Weight, and therefore the quenes ma^tis^ plesure & comanndement ys, even as her highnes hathe geven order for the deffence of thother partes, and reenforced her navy in the narrowe sees that your lordeshippe do forth with call vnto you the Shreif of that countie of Sutht: and other discreet gentlemen borderinge towardes the see and to repaire with speede nere vnto Portismowth and vppon conference together with the Captaines of Portismowth and thisle of Weight to devise all the best meanes you can possible to meet with the frenche doinges if they shall vppon the sudden which is most to be fearid attempt anie thinge that waie. And for this purpose to cause the Shire to be put into aredines vnder the leading of your Lordeshippe and other the beste and most skilfull gentelmen of that countie that will take care of this service to repaire

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with all speede vppon the fieringe of the beacons and other admonicions of the french attemptes to the see costes. And if neede shall so requier to be put ouer into thisle of wight for the Doinge whereof vppon the sodden boates are to be set in a redines before hande for ther transportacion, so as no slacknes or impediment be found at the time that seruice shalbe requisyte in this behalf. and for the better executinge thereof in time we requier your Lordshippe to be vearie earnist with the Captaines of Portismothe and the Weight, to whom we have also presentlie wryten, and to all other Captaines of fortes and bulwarkes on the see costes to stand so vppon ther garde to have ther ordinaunce mountid and their numbers and all other thinges vnder ther charge in such good redines as thenymy maie well perceive ther practises discried and sufficient force redie to meete with anie thinge they dare attempt. Whereof the quenes ma^tie^ for the trust that she reposyth in your Lordshippe nothing dovbtith but you will have that dewe care which the importaunce of the case requireth having ever regarde to meet withall ther sodden attemptes, for otherwise her ma^te^ nothing mistrustith but to make them within few daies repente ther enterprises. And thus we bid your Lordeshippe Right hertelie farewell from Windsore the XXV^th^ of Januarie 1563.

Your Lordeshippes assured loving frindes,

ARRUNDELL.
PEMBROKE.
EDW. CLINTON.
WILLIAM HAIWARDE.
FRANNCES KNOLLES.
WILLIAM CYCILL.
EDWARDE ROGERS.

After my right hartie commendacions vnto you. You shall vnderstand the Capitaines of Portismouth & Weight are commanded to lygh in theire gard with such numbers as they have. And I have receyved like commandement from the L. treasurer to cause the Shyre to lye in a redynes for this service for the better ayde of bothe the said capitaines vpon any sodeine attempte. And likewise for the body of the shere, and of your diligence here in I doubt me nothinge yet never the les for that this service is of so grete importaunce and the certeinetie of men & Armor is not knowen. Therefore this shalbe to praye you & euery of you to send me a certificat what your numbers of men be in euerie hundred & also of your Armor that the wante maie be supplied. And certificat therof made vntó my said Lord as his pleasure is. Farther signifieng you my Lordes pleasure is noe parte of thorders he hath taken for this service shalbe altered. And therefore like as I have geven you knoledge out of what hundredes the M. men for Ayde of Portismouth shall rise. And so likewise for the Ayde of thisle of Weight, & so the body of

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the Shere with the places of theire repaire vpon occacion of service. So have I thought hit mete to send you the names, as he hath heretofore appointed for the Leding of euery numbre to thende you maie the better folow the same. And because this service is committed vnto him he requireth to vnderstand how the numbers and armor will rise which must growe by your certificat which you promised to have done before this, And that as yet I here not of trusting you will consider hit is nedefull to him that is charged with this service to vnderstand the power. Otherwise his service can not be to the princes expectacion w^ch^ I committe to your wisedoms.

I have receyved from the Capitaines of Portismouth & Weight such orders as is taken by them in theire charges aswell for the fortes & botes as for the Isles. And for the wester partes of the shere I have receyved theire bokes for order of the botes and for theire sortes of Armour. But I here not anything what order is taken for Caelshotte & the botes of Leape &c which M^r^ Pattget as apperith by his hand hath taken vppon him to se furnysshed, but what is done I here not, w^ch^ I wishe maie be vnderstanded. So I committe you to God. From Letley this x^th^ of February 1563.

Yo^r^ loving friend

JOHN S^T^ JOHN.

Postscript. I praye you make certeyne yo^r^ postes & certifie them as you maie have knoledge of my Lordes pleasure as the same shall growe.

To my loving friendes S^r^ William Kayleway knight, Richard Gifford, John Foster esquyours & to the reste of the Justices of Peace assigned for the relyef of thisle of Weight in hast.

The Manuscript ends with the foregoing copy of the Privy Council's letter to Lord Seint John and with his own letter to the Justices of the Peace of the Isle of Wight.

As there is no mention in history of any invasion in 1563, the expected attack evidently did not take place; but after events show what would have been its fate had France tried to anticipate the Invincible Armada of 20 years later.

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DIRIGIBLE AIRSHIPS.

By Baron Roenne.

It is to be hoped that enterprise and technical skill may eventually lead to such perfection in airship construction, that this new means of locomotion may not only prove to be of great value in solemn national crises, but equally useful for peaceful traffic and communication.

Germany at present possesses the best aerial fleet, and is able in case of war to take in service 19 dirigible airships. This number will be increased until it reaches to at least 30 in the near future.

In view of the vast importance already attained by aerial navigation as a means of defence, and for the observation of a hostile force, to say nothing of its latent possibilities as an aggressive factor in naval warfare, it may not be out of place to describe, for the benefit of readers, the chief existing types of dirigible airships.

Those airships which are constructed after the designs of Major von Parseval are the typical examples of frameless motor balloons protected only by the overpressure of the gas contained in the bag. The gasbags must, therefore, be large enough to allow of the equalization of the gas when the cover is contracted by loss in the lower air strata, otherwise the bag would lose its rigid form and become unsteerable. In such cases the motor must be stopped, and the airship is as entirely at the mercy of the wind as an ordinary balloon. "Parseval III." has proved this fact, as in August, 1909, at Frankfurt, a gust of wind drove it upon a lightning conductor, which tore the bag and caused it to fall to earth. Another disadvantage of the frameless balloons is that the propeller must be attached to the car, thus operating, not at the centre of resistance, but far beneath it. But these airships possess at least one advantage for military purposes: they are very portable.

Siemens-Schuckert, in Berlin, have built a balloon on the Krell system, the largest non-rigid balloon hitherto constructed. Its capacity is about 424,000 cubic feet, length about 393′, and diameter 42′. The keel of the car is about as long as the whole balloon. Four motors of 110-H.P. each are built in the keel, at such distances apart as to equally divide the weight. These motors drive four propellers, which are attached, two at each side of the car, to steel tubes, in a manner similar to the French system Juillot.

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The Rheinish-Westphalian Motor Airship Company is at present building a vessel in Elberfeld on the same lines as the Parseval type; regulation of altitude, in this case also, is obtained by shifting the centre of gravity. The construction of the car and the bag is very much like the Clément-Bayard.

The airship "Ville de Paris" is built according to the design of Colonel Renard, who constructed the first French airship suitable for military purposes. Colonel Renard was the first to apply balloonets—to ensure stability—at the rear of the cylindrical part of the airship, and to fix the propeller on to the front of the car. The body of the balloon is of a conic shape, gradually tapering toward the rear, where there is an attachment carrying, at each side and at the top and bottom, two cylindrical balloonets for the purpose referred to above. The balloon itself is 201′ long and 34′ in diameter.

The motor balloon of Clément-Bayard is constructed on the same principle as the "Ville de Paris." The envelope has no frame, neither have the drop-shaped balloonets at the rear. The elevating planes and rudders are attached to the "nacelle" by a framework of steel tubes tautened by steel wires. This airship, however, does not possess two elevating planes like the "Ville de Paris," but has a similar rudder, composed of two parallel planes, attached over the rear of the car—or nacelle.

The system De la Vaulx airship, used as an advertising medium for *Le Petit Journal*, has a capacity of only 26,500 cubic feet. As the utmost carrying power of coal gas is roughly 16 ozs. to 27 cubic feet, the total weight must not be more than about 984 lbs. The envelope is made of light varnished material, and it is impossible to use hydrogen therefore to produce greater lifting capacity. The car is built of wood, and carries an 18-H.P. 4-cylinder automobile motor. The motor makes about 1,300 revolutions per minute, driving a two-bladed propeller at the proportional rate of 1 to $3\frac{1}{2}$. The De la Vaulx can carry at the utmost two persons, with fuel, oil, and ballast sufficient for a two hours' flight.

The Baldwin system airship, which has been acquired by the United States Government for the Signal Corps, also resembles the "Ville de Paris" in construction. Here the car is likewise a long piece of framework, but instead of one propeller in front the Baldwin has two! Hence this balloon has not proved itself of sufficient stability during trial flights, as it pitched rather severely. It is 58′ long, has a major diameter of 16′, and a minor diameter of 14′.

The British Army airship shows considerable improvements in construction, the antiquated form, viz., a cylindrical balloon with rounded ends, having been abandoned. The stability balloonets have been converted into gas-inflated fins, a decided improvement upon the stability balloonets of the "Ville de Paris," Clément-Bayard, and "Ville de Bordeaux," though the car is similar to that of the

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first-named French airship. The elevating plane and rudder are both attached behind, the former to the car and the latter to a floating beam over the car, whilst the axis of the rudder is fixed slightly in front of the middle, thus practically obviating all resistance in front of and behind the plane, and rendering the steering a much easier operation. The propeller is made of steel tubing with aluminium blades, and is fixed above the car. The balloon itself is about 98′ long and 23′ in diameter.

The semi-rigid airships of the French Army are the Juillot and Lebaudy systems :--The French engineer Juillot built the first semi-rigid airship in Lebaudy Brothers' workshops, which created, in 1905, a great sensation in France. In both speed and steerability this vessel was far superior to all existing types; it neither pitched, wavered, nor rolled. The second and larger airship ordered by the French Government was delivered in November, 1906, and in its turn again surpassed the first for speed. The vessel was named the "Patrie," and was lost in a storm in December, 1907. It is supposed to have been driven into the Atlantic, for a propeller from the ill-fated "Patrie" was found on the coast of Ireland.

The construction of the semi-rigid airships is as follows :—A framework of steel and aluminium tubes strengthens the balloon itself, and serves to affix the wires supporting the car. Thus it will be seen that the wires running slantwise from the ends of the balloon to the car can exert no contracting influence upon the envelope : the framework obviates such possibility. The frame is lengthened towards the rear into a cross-shaped stability plane, to which the rudder is attached. At the rear of the balloon itself there are attached several wing-shaped planes, made of double layers of material and stretched upon light frames of cane. These canes meet inside the balloon and are connected there ; thus the planes support each other, and are, in addition, stretched with steel wire. The beam is of a cross-sectional T shape ; the upper surface is entirely covered with material, and of the vertical section only the rear half is thus covered ; here the valve for the balloonet is fixed. In front of the frame an elevating plane is attached on either side, and each is regulated from the car by wires. The car, which is suspended to the beam by steel wires, is finished off underneath with a pyramidal pedestal, upon which the airship rests on *terra firma*, and can be turned in any desired direction. At the same time, the pedestal prevents the propellers from touching the ground in landing. The balloon has a diameter of 33½′, a length of 197′, a cubic capacity of 113,700′. The balloonet has a cubic capacity of 14,133′. The balloon has a lifting capacity of 2,625 lbs., and a velocity of 42′ per second.

The French Government acquired a new airship, "Republique," to replace the "Patrie." Almost of similar construction to its predecessor, the "Republique," after making 81 satisfactory ascents,

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burst in mid-air in September of 1909. This balloon had a diameter of 35½′, a length of 217′, and a cubic capacity of 128,965′. The balloonet contained 30,390 cubic feet. The whole vessel weighed 5,580 lbs., and had a lifting power of 2,844 lbs. Three further vessels were then built by Lebaudy Brothers after the Juillot system.

The airship "La Liberté" has a diameter of 35½′, a length of 233′, and a cubic capacity of 148,300′.

The "Malécot" also belongs to the type of semi-rigid balloons. It is heavier than air and is dynamically raised. For this purpose the frame is fitted with wide kite planes, which can be trained slantingly against the travelling direction by means of a sliding weight—fixed beneath the car. The planes cover an area of 1,290 square feet. Stability planes are here dispensed with, being unnecessary to this type. The balloon is 112′ long, 24′ in diameter, and has a cubic capacity of 35,330′.

GERMAN MILITARY AIRSHIPS.

Both the first and the second new military balloons of the Airship Corps are built according to the design of Major Gross. The new one is somewhat similar to the French military balloon (Juillot), in that it is also semi-rigid. It differs, however, in that the propellers operate nearer the centre of resistance, rendering the pedestal unnecessary under the car. The balloon is 217′ long, 36′ in diameter, capacity, 169,600 cubic feet. The stability planes are fitted like fins at each side, almost at the rear of the envelope. At the front of the beam is a double elevating plane, akin to the box-kite, and the other apparatus attached is covered with waterproof material. The car, of steel tubing, is attached close to the balloon with tubes and steel wires, and carries two Körting motors with water coolers, of 70-H.P. each. Under favourable circumstances, this airship could make a flight of 13 hours.

COUNT ZEPPELIN'S RIGID AIRSHIPS.

There were several things to be desired in the Zeppelin I., which made its first ascent on July 2nd, 1900. Chief of these was that a movable weight, suspended from wires, proved insufficient to effect the necessary stability in straight sailing. Zeppelin II. was wrecked in a storm near Kisslegg, in Allgäu. The third Zeppelin was completed in 1907, and worked considerably better than the others, attaining to a speed of 49′ per second.

Zeppelin IV. was burnt in August, 1908, near Echterdingen. The cause of the disaster was undoubtedly due to the ignition of detonating gas by atmospheric electricity. This gas, leaking from the outer envelope, was ignited by sparks emanating from the metal skeleton and being attracted by the trees. Profiting by the

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experience gained from Zeppelin IV., the airship Zeppelin III. was enlarged from 413′ to 446′, retaining its original diameter of 42′, but extending the cubic capacity to 530,000′, which space is divided into 17 separate compartments, or balloons. The inner skeleton is composed of 16 longitudinal sections, tapering together and meeting at either end. These are surrounded and bound together by 16 hoops, each of which is held together by spokes like a bicycle wheel. The square spaces between the long and cross sections are fortified by wires stretched diagonally across. The 17 balloons are kept from contact with the outer envelope by ramie-laces; the object being to allow of expansion when the airship is subjected to sun rays, which warm the gas and enlarge the balloon. Loss of gas is thus prevented. At the same time, a sudden cooling cannot occur if the vessel is passing through clouds. In order still further to strengthen the framework, a long skeleton gangway is attached underneath the balloon, to which the cars are fixed, at a distance of 82′ from either end. The cars are only 6½′ from the bottom of the balloon. In each of the cars is a small Daimler motor of 115-H.P., driving two propellers, consequently the airship is driven by four propellers. The propellers are attached to the sides of the balloon itself by means of brackets. Recently, however, another motor and two more propellers have been added to the centre of the vessel, so that Count Zeppelin was enabled to attain a speed of about 56 miles per hour. Two rudders at the rear guide the vessel, each composed of three parallel planes of 43 square feet, and attached between two stability planes. These last named are about 42′ long, with a superficial area of 332 square feet. To prevent rolling and wavering, another and similar plane is fixed on top of the balloon. The rudders are worked from the forward car. The elevating planes consist of four movable kites, two attached at each side near front and rear. They can be worked separately or together. Each plane is made up of four parallel planes of 121 square feet. At full speed they generate a pressure of 1,312 lbs., and are capable of raising the vessel dynamically a height of 1,640′. Sufficient benzine, oil, and ballast can be carried for a 40 hours' flight.

Rigid airships can only be constructed on a very large scale, as the skeleton alone requires from 25 to 33 per cent. of the total lifting power. Thus the smallest possible model of the Zeppelin would require a cubic capacity of at least 247,330′. Such a vessel, however, is much safer in the air than one of the limp or semi-rigid system, but dangerous when standing on the ground; although there is less necessity for frequent descents in order to replenish the gas, it must, nevertheless, descend in case of storm, and is still liable to destruction if it does not land near its garage. Still more dangerous would be a descent upon the sea, as the waves and wind would speedily destroy the whole vessel.

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Baron de Marçay has supplied the French engineer Kluytmann with the necessary means to carry out a novel and interesting method of airship construction. The idea is to place the propeller in the exact centre of resistance. To carry this out, Klutymann has divided the balloon in the middle, separated the two halves by a circular steel frame, and here inserted the propeller, the blades of which protrude from the sides, top, and bottom of the envelope when in motion. The little model constructed on this principle proved that the position of the screw, at any rate, was not without its useful point. Beyond the frame fixed in the middle, the balloon was of the non-rigid type.

Another example of the non-rigid airship was that of the American engineer Morel. It was about 328′ long and 33′ in diameter. Morel's idea was to inaugurate an express airship service between New York and San Francisco, but disaster overtook him. The vessel was too weak in build; at its first ascent, in 1908, with 20 passengers, it reached a height of 491′, burst, and crashed to earth, killing 13, among whom was the engineer himself.

Of the many airships now in course of construction, I will only describe the more important of the rigid types. Zeppelin is building two airships, one to carry 40, and the other 400 persons. The latter will resemble Herr Wetzel's very closely, excepting in the construction of the skeleton and the disposition of the motors and propellers.

Professor Schuette in Danzig is building a rigid airship, now approaching completion, of 426′ long, containing a wooden skeleton, and, like the Zeppelin, divided into 17 compartments.

The engineer Prill, of Hamburg, is engaged upon an airship the skeleton of which is formed of steel. Brand also intends to adopt this method. Prill has also adopted the idea of the vacuum airship, which the Jesuit de Sana described in his works so long ago as 1680. Prill proposes to use hard rubber for the envelope. He calculates for a balloon of 556′ in length, 59′ in diameter, and 0·8 vacuum, to possess a lifting capacity of 72,187 lbs. With such an enormous bag he intends the wall thickness to be only 0·1575″, which would give the balloon a weight of 52,000 lbs., leaving a balance of 19,687 lbs. carried.

Herr Rettig in Berlin is building a rigid airship, like Schuette, of wood. But instead of constructing a wooden skeleton to go inside the envelope, he proposes to make the envelope itself of wood. Thin boards are tightly fitted together and rendered airtight. Herr Rettig hopes to attain a greater degree of density by this means than with waterproof material.

Herr Albert Wetzel has completed arrangements in Stuttgart for the construction of a gigantic airship. The vessel is to have a length of 984′ and 65½′ in diameter. The envelope is to be composed of a

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magnalium alloy. Corrugated sheets of this material, 0·0167″ thick, are to be welded together on the Schoop system. The form of the envelope is to be cylindrical, and strengthened inside with 151 tubular hoops tautened with wires like bicycle wheels. In the two ends of the envelope oil and benzine tanks are to be fitted; in order to tilt the front of the vessel upwards or downwards, the liquid is to be driven from one end to the other by pneumatic pressure. Quite a novel departure is the idea of fixing the eight motors on the front end of the cover, beneath and on top. A car of about 500′ in length will be suspended 30′ below, and provided with only one rudder!

The opinion prevails that Germany, with her Zeppelins, is far in advance of other countries. This is true, but only so long as no other and more practical vessel is built, for the carrying power and the safety of these are insufficient for any serious purposes of peace or war.

Although no inventor has as yet succeeded, it is, nevertheless, possible even to-day to construct a dirigible airship which shall satisfactorily fulfil all the demands made upon it. But in order to do this it will be necessary to recognize the most correct solutions with the aid of modern appliances, and not, as has hitherto been generally the case, to obstruct *great advantages with perhaps greater disadvantages.*

All airships up to now have been *compelled* to land during a storm. The law, however, does not demand this; but it does demand a rigid airship which, in any case of danger, shall sail into that domain to which it belongs, namely, the air. This condition is, unfortunately, not fulfilled by the existing rigid airships.

That airship is the best which in any circumstances runs the least risk of danger, which need not land involuntarily, and which can at any time ascend into the air.

One would imagine, from all that has been spoken and written, that very many years of experience were still necessary in order to produce something worthy in this art, and that considerable progress is, for the time being, impossible. This is wrong! It is only a question of appreciating and correctly utilizing the means at our disposal. British industry can supply everything desirable for aerial navigation, and that to a remarkable degree of perfection,—be it for the construction of flying machines or of airships, or possibly in a more limited measure for aeroplanes.

All methods of human transport,—railways, ships, or automobiles, point to the necessity of the traffic working without any co-operation on the part of the passengers. In other words, the attention of passengers must not be distracted by the means of locomotion, thus creating a feeling of perfect safety and comfort. They should enjoy the beauties of nature in the passing landscape, or consider peacefully the plans to be carried out on arrival at their destination.

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Social conditions demand rapid transit, with a minimum of expense and loss of time. These considerations absolutely preclude the possibility of solving the problem by any imitation of the flight of birds. Let the exertions of progressive nations be ever so great in the domain of aerodynamics, they will never achieve anything for more than sporting purposes with aeroplanes. I will not touch upon the scientific aspect of the question. Flying machines have this in common with motor cycles: they claim a certain amount of skill and presence of mind from the operator, thus limiting the area of practical utility. The project of flying to Africa and back in a day, which is the dream of the German aviator Wanderfalkeh, will no doubt be abandoned, as was also the hopeless attempt to attain a speed of 150 miles per hour on the experimental electric railway between Mariendorf and Zosen. Seagulls are frequently blown into the water: what chance, then, would the best aeroplane stand, a machine not by any means so qualified for flight as a bird, and possessing, furthermore, no instinct of equilibrium.

All these considerations indicate that the way to the above-mentioned goal lies through the airship, and not the aeroplane.

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THE FYERS FAMILY.

(*Continued.*)

LIEUT.-GENERAL SIR WILLIAM AUGUSTUS FYERS, K.C.B., COLONEL OF THE DURHAM LIGHT INFANTRY.

(*Continued.*)

The 2nd Battalion of the Rifle Brigade returned from the Crimea six months after Capt. and Brevet Lieut.-Colonel W. A. Fyers had gone home on leave, and was at first sent to Aldershot, where he rejoined it. After the battalion had been reviewed in London by the Queen, it was moved to Dublin in the summer of 1856, and a year later was hurriedly ordered to India to assist in putting down the Mutiny. In the meantime Lieut.-Colonel Fyers had been promoted on 16th June, 1857, to be a Regimental Major. The battalion was divided into three bodies; the second of these, under Fyers, embarked at Kingstown on the 4th August, 1857, in the *United Kingdom*, transport, but did not reach Calcutta until the 7th November. Leaving Calcutta with the detachment by rail for Ranigang on the following day, Fyers went on in advance from that place, reached Benares on the morning of the 16th, left again the same evening, and got to Allahabad on the 18th November. There, amid all the hurry, bustle, and excitement that surrounded him, he began a letter home, telling how he had already snatched a few minutes at Benares to write to his brother Henry in the Artillery, in order that they should get news of him. This letter from Allahabad was continued even on the forced march to Cawnpore. The following extracts are taken :—

Extracts from a letter from Bt. Lieut.-Colonel W. A. Fyers, Rifle Brigade, begun at Allahabad, and dated 12.30 *p.m., 18th November*, 1857.

"I have arrived here about one hour, and having breakfasted at the Dak Bungalow, find some paper and a little quiet to write to you. I left Benares (without seeing anything of it) on the evening of the day of my arrival . . . having a detachment of about 200 (88th), as well as my few Riflemen (11), with me. The whole of the battalion is behind, with the exception of 20 men, along with myself and Colonel Woodford; the rest of his detachment and mine are on the road following up. This arises from the different modes of conveyance, there being three—horse dak, bearer dak, and wagons with bullocks. They travel fastest in the order above, and consequently we, having gone in the first, are ahead of all the rest. Whether we wait here until all come up or go on to Cawnpore at once I do not yet know, but I rather think the latter.

"I believe there is still some sharp work before our army, as the Mutineers, who are chiefly men of Oude, are, it seems, resolved to fight

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it out with us in defence of that territory. As far as I can see, our annexation of that country appears to have been the match that fired the magazine. Lucknow, the chief city, is at this moment being bombarded, and we shortly expect to hear of its fall. There are other forts, and strong ones too, I believe, in their hands, which must be taken. I fully expect to have some sharp work, and though, by the goodness of God, I have hitherto wonderfully escaped from injury, yet the chances are great against my coming out scathless. . . ."

Before continuing the extracts I find that, according to Cope's account, Fyers waited at Allahabad for the detachments to come up; both Woodford's and Fyers's divisions left that place by rail on the 23rd, and reached the terminus at Lohanga the same day. Here they again divided, Woodford's detachment proceeding by bullock carts, and Fyers's by route march. Fyers marched from Lohanga at midnight of the 23rd—24th, in charge of commissariat stores carried on donkeys; he halted after about 16 miles. Another march of the same length brought them to Fatehpur on the 25th, the stores in their charge being a great impediment to their progress. Leaving Fatehpur the same night, they marched some 17 miles, and just as the men were pitching their tents about 8 a.m. on the 26th a messenger on a camel arrived from General Windham at Cawnpore. The messenger had already met Woodford's detachment and hurried it forward, and now came up to Fyers with a pencil note from the General, urging him to make all speed, as troops were wanted.

At the halting place, which is not named, where Fyers received Windham's message, and while his men were resting, Fyers continued his letter home :—

"*26th November.*

"I had it not in my power to finish this in time for the last mail. Ever since leaving Calcutta we have had to go through great fatigues, and since I wrote the above, having stopped at Allahabad for I think three days, we have had abundance of work. . . . Since leaving Allahabad we have been making long marches at night, tiresome because so slow. Last night I started with my detachment of 233 men, and did not reach this place until 8 in the morning.

"While pitching a few tents, an express messenger came with a note, directed to Colonel Woodford and myself, from General Windham at Cawnpore, pressing on us to make all speed, as a large and fine force, the Gwalior contingent, was close to him with a large park of artillery, 36 guns, and a siege train; he has about 2,000 men. The messenger met Colonel Woodford last night not far from Cawnpore, and he would reach it shortly after. He went ahead of me with a bullock dak, while I have had to march with a large convoy of commissariat things, etc., etc. We did 17 miles last night, and I intend to push on to-night with elephants (10) and camels only; the distance I have to complete before 8 to-morrow is 32 miles.

"I have set the elephants apart for the sick and fatigued men only.

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I reckon for 12 hours, allowing two hours for a halt for food and rest. The men are very much knocked up with having so little sleep, and very many are suffering greatly from their feet; however, I am sure they will make the effort, and will succeed in reaching the place so as to be in time for anything that is going on. General Windham said in his note he expected a row to-day (this day) or to-morrow, the 27th.

"To-day we have heard a great deal of firing (cannon) in either that direction or Lucknow; it is difficult to judge which. Artillery, our 3rd Battalion, and then our headquarter wing, are now on the road following our steps; they will shortly be up. Lucknow is, I fancy, already in our hands, or very nearly so. We literally hear nothing of the operations going on. You would be pleased to hear of their success there, and of the junction with General Havelock; the despatch was shown to me at Allahabad. I fear the losses are great, for the ruffians are very desperate.

"There is a chance of my being obstructed in reaching Cawnpore, but I will feel my way at daybreak with caution. I fancy it is the object of the Gwalior force to invest the entrenched camp of Cawnpore. I fear we are badly off for guns. Your old friend Jock Anderson is on his way with his men of a troop of Horse Artillery; he gets his guns and horses at Allahabad. A battery is about three marches on this side of Allahabad. They have had very great difficulty in getting horses. General Dupuis and his Adjutant-General, old Adye, passed through Allahabad while we were there. . . . At Allahabad I fortunately lighted on a strong Cabooly pony, quite a weight carrier (300 rupees), and as I have had to march, this is very fortunate. . . .

"Though I have gone through so much fatigue lately, I am quite well, and hope, with God's blessing, to remain so. I am very glad Windham is in command; there must necessarily be a bond of interest between us. I wrote him a hurried note on my knee in acknowledgment of his, saying that I would do all in my power to press on. The post camel that brought his message took back mine. As you may suppose, I am now very much taken up with my present work, and have but little time for the pen. I have taken upon myself to part with all the incumbra of my line of march, carts and what not. I have a rope ladder made this evening to accelerate the climbing the elephants by the cripples. Our servants go on elephants for the first half of the march, and then make their way on foot. It would have amused you to see us at work making this. The men have, I hope, put in some sleep; I cannot say I have, for my thoughts have been too busy. I may yet however get a snatch. . . ."

Leaving the commissariat stores he had been escorting in charge of the local police at the halting place, and carrying with him only what was necessary, Fyers started with his detachment for his 32-mile march. He allowed his men frequent short halts on the way, but many of them were so fatigued that when a halt was sounded they fell asleep almost as soon as they lay down on the ground.

In the early morning of the 27th Fyers gave them an hour's rest and a ration of rum. At daybreak he halted for a breakfast of tea

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and biscuits. Then, weary, hot, and footsore, the men marched on. At length the near sound of booming guns and rattling musketry fell on their ears from the direction of Cawnpore. These sounds seemed to put fresh life into them, and, inspired with the hope of being in time for the fight, they pushed on and were able to join in the fray, arriving about 2 p.m.

When it is remembered that the men were wearing European cloth clothing and shakos, this march may well have been considered a splendid performance.

General Windham's camp lay outside the town of Cawnpore on the S.W., and not far from the Great Trunk Road from Allahabad. The fort and entrenchments were on the N.E. of the town, covering the bridge across the Ganges. The enemy were enveloping Windham's camp from the S.W. to the N.E.

General Sir John Adye, in his *Recollections of a Military Life*, says :—

"November 27th proved to be a very eventful day. Our small field force, as I have explained, was camped outside the city, not far from the point where the Great Trunk Road crossed that from Cawnpore to Calpee. General Windham naturally hoped that the successful blow he had delivered on the previous day would, at all events, so far tend to discourage the mutineers as to delay their movements and give time for the return of the Commander-in-Chief. The position however was critical. . . .

"About 10 a.m. a cannonade suddenly commenced away on the right, followed shortly afterwards by a similar demonstration in front. The mutineers were evidently determined to make a simultaneous attack on both points, and although for the time they held back their infantry, their artillery fire was very severe and continuous. . . . Not only was the fire incessant, but there were indications that our left as well as our right was threatened—in fact, the enemy were in great strength (in a semi-circle) all round us. The battle continued for several hours without signs of abatement. Our ammunition was running short, and the bullock drivers began to desert.

"Under these circumstances General Windham directed his troops to fall back a short distance, until they found a temporary shelter under cover of some mounds and remains of old brick kilns just outside the city. It seemed now that the position might be held. Still anxious about the right flank, late in the afternoon he sent an aide-de-camp to obtain information, and shortly afterwards directed me to ride through the streets and ascertain the state of affairs. Whilst threading the narrow lanes I suddenly met the aide-de-camp coming back in haste, who informed me that the mutineers were in possession of the lower parts of the town, and had just fired a volley at him. At this moment Windham himself joined us. Whilst deliberating on the critical position, two companies of the Rifle Brigade also appeared on the scene, as if they had dropped from the clouds. They had been marching all day up the Trunk Road, hearing firing in various directions, but unable to find anyone to give them

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information. Windham said a few words to them, and, placing himself at their head, away they went cheering, and soon cleared the streets of the enemy."

Fyers, whose letter from Cawnpore I shall presently quote, says he arrived there about 2 p.m. on the 27th. General Sir John Adye says he met the two companies late in the afternoon. Some time may have been occupied between the time of arrival and the meeting with Sir John Adye. It must have been soon after Fyers and his men had cleared the streets that orders were given to withdraw the whole force from the front and concentrate at the entrenchments on the Ganges, in order to hold that position and prevent the bridge of boats being destroyed. Fyers must indeed have been thankful to get there and to be able to refresh his men with an issue of grog, biscuits, and tea. The retirement through the town to the fort or entrenchment had been conducted without haste and in good order. As soon as the men had partaken of this slight refreshment, they went on outpost duty at an outwork of the entrenchment.

"On the 28th," says Cope, "the Riflemen were ordered, about six in the morning, to come into an outwork of the entrenchment, where, having been supplied with some biscuit and tea, they were ordered out to resist the enemy, who were expected to make another attack. The Rifle Companies, with part of the 82nd Regiment, and Capt. Greene's battery of Artillery, were posted on the left of the canal, looking from the entrenchments. In moving to this position they were exposed to a heavy fire of musketry and grape. The action itself began about noon, and after hard fighting these troops repulsed the enemy. . . . In the course of the fight Colonel Woodford, Lieuts. Playne and Nicholl, with three Riflemen, were in a dip in the ground, in front of the enemy's guns, and were making good practice in picking off the Gunners, when Woodford, who was in the act of taking a shot with a rifle at a Sepoy, was shot through the head, and uttering an exclamation, expired. . . . The Riflemen took two long 18-pr. guns, and the men, having tackled-to with ropes, drew them into the entrenchment, a distance of more than 3 miles. On their arrival they were greeted with a round of cheers for the guns, and another for the Rifles, and, amidst great excitement, civilians and soldiers pressed forward to offer congratulations and refreshments to the gallant captors.

" . . . During the night of the 28th the enemy took entire possession of the town, and on the 29th began a heavy fire against the entrenchment, hitting the bridge of boats over the Ganges several times, damaging the hospital, and destroying stores. The Riflemen, who had during the night and morning occupied the principal outwork of the entrenchment, were ordered out by Sir Colin Campbell (who had arrived at Cawnpore at sunset on the 28th) to take some guns which were doing much damage. Accordingly at

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3 p.m. two companies of the 2nd Battalion and Atherley's Company of the 3rd, under Lieut.-Colonel Fyers, who had succeeded to the command on Woodford's death, made a sortie. Running out over some very uneven ground, they attacked some Sepoys who were in the Residency, and were for some time exposed to a very severe fire. However, after a while, they drove the enemy out of these buildings, and as they were escaping by the back of the compound, some Riflemen of Atherley's Company crept round stealthily under the wall and succeeded in catching the retreating rebels on their swords as they leapt over it. They thus slew a large number. However, as they did not receive reinforcements, they were unable to take the guns, and returned to the entrenchment.

"The Riflemen, or some of them at least, had not had their clothes off since they left Allahabad (on the 23rd); had been scantily fed, often being for 24 hours with only one meal, and sometimes that only of biscuit and tea or rum; exposed to heat by day, and great cold by night, and suffering from sore feet; yet they kept their spirits up, and did their work on these four hard-fought days in a manner to elicit General Windham's marked approval repeatedly expressed to them."

A somewhat different account of the engagement on the 28th is given by Colour-Sergt. William Cox, of the 2nd Battalion of the Rifle Brigade, in an interesting statement he wrote out and signed. He tells us that the 2nd Battalion marched out at early dawn, tolerably well supplied with water and ball cartridge, a large number of steel pins being also served out to spike any guns that might be captured. Advancing in skirmishing order (about 6 paces) under a heavy fire of round shot, while bringing up the rear of his company, he was joined by Lieut.-Colonel Fyers, who, sword and revolver in hands, brought up the rear guard. From the cover of some irregular mud walls a level plain stretched before them, and at a distance of 500 or 600 yards they saw three 18-pr. muzzle-loading guns, which kept up an incessant fire, being well served by the Sepoy gunners.

The 2nd Battalion of the Rifle Brigade was the first regiment sent out armed with the short Enfield rifle, sighted for 1,100 yards, and the Riflemen soon "played havoc among the Sepoy gunners," who as soon as they came forward to load were "knocked over like nine-pins." The guns were then retired, and "Lieut.-Colonel Woodford, seeing that they were harnessing their elephants to one of the three guns, gave the order to 'fix swords' and 'charge.' This charge was led by Lieut.-Colonels Charles Woodford and William Augustus Fyers, and while leading thus, the former was unfortunately killed.

"The enemy got one of the guns away safely, while the other two fell into our hands, and one of these was spiked by the pioneer of my own company (by name Sandy Robinson). We found the Sepoy gunners lying in heaps round the captured guns, with their uniforms

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smouldering on their dead bodies, having been intentionally set on fire by their comrades, doubtless in accordance with the rules of their caste. We noticed that scores of our bullets were imbedded in the woodwork of the swivel sighting-boards on the breech of each gun, showing that the gunners must have had a hot time of it, and that they must have stuck to their posts most manfully, and worthy of a better cause."

A difficulty then arose. How were they to get the guns into the fort over a mile away? Evidently they had no ropes with them, as stated by Cope. The colour-sergeant says they soon solved the question, for "we took the loose slings off our rifles and made drag-ropes of them, all hands joining in the work with hearty good-will, and frequently having to use the handspikes attached to the limbers to extricate the wheels from the numerous ruts into which they continually fell."

As they were nearing the fort a detachment of the Naval Brigade came out to bring in the guns, but, says Colour-Sergt. Cox, "Lieut.-Colonel Fyers courteously declined their assistance, telling the officer in charge of the sailors that as we had captured the guns and brought them in safety thus far, we were quite qualified to take them into the fort without any extraneous assistance. This we did amidst the deafening cheers of the crowds within the fort, military, naval, and civilian."

There would appear to have been some dispute as to the capture of the guns when the histories of the Mutiny came to be written. Sir John Adye says: "Away on the left in the open plain, near the ruins of the 'Old Dragoon Lines,' the Rifles, with part of the 82nd and a battery, after a hard-contested fight, drove back the mutineers in a brilliant manner and captured two 18-pr. guns." At any rate Colour-Sergt. Cox is not in any doubt. He adds emphatically:— "This I do know, and will maintain with my latest breath, that the four companies of the 2nd Battalion Rifle Brigade, *unaided*, captured the two 18-prs. alluded to, and brought them safely into the fort, where a few days afterwards they were able to retort upon their late possessors. . . ."

In a letter from Lieut.-Colonel Fyers himself, written at Cawnpore on 30th November, he refers to the events of the last few days:—

"CAWNPORE, 30*th November*, 1857.

"I arrived here at about 2 p.m. on the 27th, after a forced march of 50 miles, and as soon as we got into cantonments was met by a Staff officer, begging me to proceed immediately to the scene of action. From 12 o'clock we had heard the guns going hotly, but were not prepared to find things in the state they were. General Windham had made a great mistake, as you will have seen by the accounts from here. He had retired from his ground that morning under the impression that the enemy were making an advance on the fort of Cawnpore, which of course was to him a matter of great concern and importance. His

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information came from bad sources. The consequences of his retiring were the loss of his camp equipage and almost everything belonging to the troops. To be sure the numerical superiority of the enemy, as well as their great strength in artillery, may be regarded as some excuse for this false step, but I think a bolder course would have been the better of the two. I have heard a good deal of talk about the misconduct of some of our troops, and I fear there is too much ground for it. You may imagine how the strength of my detachment has been taxed since their arrival. At first there appeared to be quite a panic in the minds of all, and we were dragged here and there by orders and counter-orders. The day's work finished by our getting no food and having to man one of the outworks of the fort. This was not all, for I had to set a proportion of the men to work on the unfinished parapets, get up sandbags, and all that sort of work. Having had a little sleep, I was summoned to the General's Quarters to a Council of Commanding Officers of Corps, and remained there some hours. . . . It was determined to beat up the enemy the next morning, and the plan was explained on the map. On the next day we accordingly started to our different points, and in good course of time came in contact with the enemy's troops, the result to us on the left being that we forced them to retire with considerable loss. The right did not succeed so well, and met with considerable loss. Our loss in officers was, considering, a good deal, and as poor Colonel Woodford fell, certainly hit us hard. We had however the satisfaction of capturing two 32-prs., and brought them in. These guns were taken chiefly, I am happy to say, by three companies under my orders. I have the satisfaction of believing that they (the companies) worked well in spite of the fact that I could get *no fresh ammunition*. How this arose I can't say. I tried every means in vain. I had seized some excellent points which gave me cross fires, and the Enfield rifle, under the good management of the captains of companies, did a great deal of execution, and especially damaged the before-mentioned guns, that is, their powers of locomotion and of being dangerous, which they had proved themselves to be by the showers of grape they sent among us. We must have done much mischief also among their cavalry. We however walked off with the guns triumphantly, some others interfering with our movements by keeping up a brisk fire. I found a couple of companies of the 34th, I think, doing little or no good, so I walked them off to a brick kiln and some cottages, and showed them how to use their rifles on the guns who were annoying our people. When they had got out of the range of these guns, I saw a mounted officer of the regiment these companies belonged to, and gave them up to him and joined the R.B.'s, having the honour of conducting them into the fort with their prize guns as commanding officer. You may imagine the day's work gave me considerable satisfaction, damped though by poor Woodford's death. . . ."

From December 1st to the 5th Fyers and his Riflemen continued to occupy the outwork of the entrenchment, the enemy keeping up an intermittent gun fire on them. In the meantime Sir Colin Campbell was busy sending off all the wounded and the women and children

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he had rescued from Lucknow to Allahabad. When these were well on their way, and had got beyond danger, he was free to act with a strong hand against the rebels. The Riflemen joined Sir Colin's camp at the "Old Dragoon Lines" on the afternoon of the 5th. By this time the 3rd Battalion had arrived there from Allahabad, under Colonel Horsford, and the two battalions were brigaded under Brigadier Walpole.

Although the enemy was in full possession of Cawnpore, their main position and camp was outside the city, and on the west of the Great Trunk Road. At 10 o'clock on the morning of the 6th Windham, who was in command of the entrenchment, opened fire from all his guns and mortars on the city and on the enemy's left. This continued for two hours, and the rebels in the city were destroyed in great numbers. More and more rebel troops were brought in to repel the expected assault, and their right was left unsupported. Then the bombardment ceased, for Sir Colin's way was clear. Greathed's brigade closed on the line of the canal and kept the enemy's centre occupied, while Walpole's brigade crossed the canal; the Riflemen deployed, and fixing swords, advanced and soon extended and cleared the ground between the canal and the city, and prevented any column of the enemy debouching from the streets to the assistance of their right. Then they moved towards their left to connect with the force which had crossed the canal by another bridge. Soon they saw the rebels flying towards their camp, hotly pursued by our troops. So, continuing to advance in skirmishing order, the two battalions swept the ground between the town and the Great Trunk Road, passing the brick kilns, and through suburbs and trees, till they came in view of the enemy's camp, which they at once occupied, while other troops were pushed on in pursuit.

Later in the day, leaving the charge of the captured camp to others, they took part in Mansfield's futile attempt to cut the rebels off from the Bithur Road by seizing their position at Sabadar's Tank. "In front of the tank," says Cope, "the enemy had some heavy guns; some distance on the right of the Riflemen was another gun, and two more a little to the left. These were well protected by earthworks or walls; a considerable body of rebels kept up a musketry fire from tops of trees and enclosures; and the Riflemen were exposed to showers of grape, canister, and round shot. They advanced extended about 300 yards on each side of the road, slightly in advance of some heavy guns, while the 93rd were kept in reserve. The fire of these guns soon began to tell on the enemy. This, and the approach of the long line of extended Riflemen, soon disheartened the enemy, who began to give way immediately on the Riflemen passing through the enclosures to the right and the broken ground to the left of the road. On reaching the entrance of the village, called the Soldiers' Burial Ground, the guns of Capt.

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Middleton's battery were pushed through as rapidly as possible, the Riflemen running up to support them. They got very near the gun on their right and the two on their left, and were in hopes of capturing them, but they were so much delayed by having to climb over mud walls and pass through enclosures to get at them, that the rebels succeeded in removing them by the right and left, and took them among some houses which the Riflemen had orders not to pass."*

The Rifle Battalions pursued the enemy, now completely routed, until about 5 o'clock in the afternoon, when a halt was called at some unoccupied houses for the night. Here the 2nd Battalion got hold of some sheep, and had such a feast of mutton that they named the house "Mutton Bungalow." On the 8th they moved in to Cawnpore, and then joined Sir Colin Campbell's camp some 4 miles in advance. The headquarters of the battalion, under Colonel Percy Hill, all this time had been delayed, and did not reach Cawnpore until the 15th December.

Sir Colin Campbell now decided to sweep the Doab of rebels. Brigadier Walpole's brigade was directed to make a semi-circular sweep to the left through the Lower Doab on Manpuri, and finally to move on Fategarh, whither Sir Colin himself intended to march with the main body of the army.

On the 18th December, 1857, both battalions of the Rifle Brigade, forming part of Walpole's brigade, marched off on this expedition, in which there were many long marches and little fighting, the enemy generally flying on their approach. They joined Sir Colin at Fategarh on the 4th January, 1858. On the 13th they were sent to Aligarh to protect the passage of the Ramganga River, but soon returned to Fategarh, whence, on the 4th February, they made another sweeping march, reaching Cawnpore on the 11th. During this month Sir Colin Campbell was awaiting reinforcements and maturing his plans for the Siege of Lucknow.

The two battalions of the Rifle Brigade now formed a brigade, under Colonel Horsford, in the division commanded by Brigadier Walpole. Fyers marched with his battalion from Cawnpore on the 27th February for Banthira, where the whole army encamped, and on the 3rd March they started for the Alambagh. Walpole's division was to form part of Outram's force. It was at the Alambagh that Outram had taken up his position in November, 1857, when Sir Colin Campbell left him with the garrison of Lucknow, which he had

* Holmes, in his *History of the Indian Mutiny*, says that Mansfield "had before him the chance of forcing something like two-thirds of the entire army to surrender. When he reached the tank large masses of the enemy were already retreating. He opened fire upon them, but, in spite of the remonstrances of his officers, would not allow his infantry to advance. . . . He might have captured their guns if he had not shrunk from incurring the loss which an attack upon their position would have involved."

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relieved, with directions to watch the city until Sir Colin should find himself able to lay siege to it. In spite of the small force at his disposal, Outram had gallantly held his ground and defeated numerous attacks of the rebels.

On the 6th March Outram crossed the Gumti River and encamped his whole force near the Faizabad road. "On the 9th March he made his attack; himself leading the left column across the Kokrail stream, he seized the Chakar Kothi, or Yellow House, the key of the enemy's position in that quarter, and, driving the rebels to the river, threw up batteries on its bank to keep down the enemy's fire and explode the works in rear of the Martinière. On the 10th March he strengthened his position, repelled the attack of the enemy, and kept up the fire of his batteries upon the Kaisar-bagh and main street. The Kaisar-bagh fell to Sir Colin Campbell on the morning of the 14th. On the 16th Outram, having re-crossed the Gumti, advanced through the Chattar Manzil and carried the Residency. On the morning of the 19th Outram attacked the Musa-bagh, held by 5,000 men and 13 guns, and carried it, capturing 12 guns. So ended the capture of Lucknow."*

And what part did the Riflemen take in the fighting of these 11 days? On the 9th they advanced in skirmishing order in front of the contiguous columns, and after fording the Kokrail stream, found themselves in front of a small village, strongly situated in broken ground, which was well wooded. Lieut.-Colonel Fyers took his company to attack the village, but the rebels retired. On coming to the Yellow Bungalow, the Riflemen went for it with a rush.

On the following day the Riflemen shifted their camp to the neighbourhood of the Yellow Bungalow and furnished the outlying picquets. On the 11th they took part in a reconnaissance in force to ascertain the possibility of crossing by a bridge to Lucknow. They led in skirmishing order among orchards, by buildings of various kinds, and through narrow streets. "They skirmished through these as well as they could, each captain acting in a measure independently and handling his company as he thought best. The streets were so intricate, and the continuity of the battalions so broken, that no other system was possible. The Riflemen worked their way through these obstructions, and reached the mosque on the Old Cantonment road, which commands the approach to the Iron bridge. . . . Leaving the mosque in charge of other troops, they proceeded to fight their way to the Iron and Stone bridges. . . . The camp of the rebel 15th Irregular Horse was surprised, and two guns and the standard of that regiment were captured by the Riflemen. . . . Eventually the Riflemen cleared the whole of the suburbs near the Old Cantonment road as far as the Iron bridge."† The casualties of the battalion

* See "Outram," *Dictionary of National Biography*.

† Cope's *History of the Rifle Brigade*.

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to which Fyers belonged were considerable, and two officers succumbed to the wounds received on this day.

On the 19th March the 2nd Battalion was detailed to hold the Iron bridge and the 3rd Battalion the Stone bridge, while the force on the right bank of the river cleared the city of Lucknow of the remaining rebels. They took up their position at 7.30 in the morning, and remained there for 10 hours. But they were not actively engaged, as the rebels did not venture to try to cross the bridge in face of so strong a body of men.

After the capture of Lucknow the 2nd Battalion formed part of the movable column, under General Sir James Hope Grant, which did such good work in stamping out the embers of the rebellion in Oude and across the Gogra. The battalion had no rest. From April to the end of the year they were incessantly marching and frequently fighting, and it was not until July, 1859, that they occupied barracks. For 20 months they were in the field, often bivouacking in the open; they had marched about 1,750 miles in 160 marches, and the company officers, of whom Fyers was one, had accompanied their men on foot. It is said that they were the only infantry battalion that had kept the field the whole time, from their arrival in India in November, 1857, until the end of the Mutiny campaign in July, 1859.

In these constant marches, in such a trying climate, Lieut.-Colonel Fyers took his part until broken down in health he was forced to give in, and his name frequently appears in the Records; but I have not space for many such references, and a few must suffice.

On the 23rd April, 1858, he commanded 200 riflemen at the destruction of the fort of Jangarabad.

On the 10th May, in the pursuit of Beni Madho, when the thermometer marked 118° Fahr. in a tent, and men were struck down by the sun in great numbers, at the close of the day they came up with the enemy, but it was too late, on account of the light, for more than a smart skirmish. Colonel Fyers, with two companies, captured a gun. "It was getting dark, the 'retire' had sounded, and all had joined the main body except these two companies. The gun was heavy, the ground bad, and the men worn out by heat and fatigue. They made little way with their gun, and it became dark. Then some horsemen appeared on the left. . . . At last they came near, and Colonel Fyers challenged; the reply was not satisfactory, and he fired his revolver. The Riflemen at once poured a volley into them at 30 yards, which emptied half the saddles, and then fixed swords. But the horsemen fled. . . . The Riflemen, not without difficulty in the pitchy darkness, rejoined the battalion."

Worn out by the privations and fatigues of the campaign, Fyers at last succumbed, and had to return home in June, 1858. For his services in the suppression of the Indian Mutiny he was mentioned in

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despatches was made a Companion of the Bath on the 17th June, 1858, and was given the war medal, with clasps for Cawnpore and Lucknow.

It would seem that Fyers must have been recommended for the Victoria Cross for his gallant conduct at The Alma, for writing from Lucknow on the 10th April, 1858, he says:—"Lord Panmure did me the service of scratching my name from the list, when it had *actually* passed the Committee, for the Victoria Cross."

On the 28th September, the same year, he married, at Kingswood,* Surrey, Mary Stuart Nepean, daughter of Rear-Admiral Evan Nepean, R.N., and of his wife, Mary Stuart, daughter of Rear-Admiral Henry Stuart, R.N. The bride was born in 1829. Her father was the second son of Lieut.-General Nicholas Nepean, by his marriage with Countess Johanna Francina von Host Wedekind, and nephew of Sir Evan Nepean, 1st Bart. (Secretary of the Admiralty, and afterwards Governor of Bombay, etc.).† Her mother's father was nephew and heir to General James Stuart, who was Colonel of the 72nd Highlanders. It was a pleasant coincidence that the Warrant for his C.B. reached Fyers on the morning of his wedding.

Fyers returned again to India in July, 1859, to do duty with his battalion. He remained in that country in command of the battalion for eight years, except for a short interval, until he returned home with it in the autumn of 1867. He was then quartered at Devonport. In the meantime, during his long service in India, he had been promoted Brevet Colonel on the 8th June, 1864, and granted a Distinguished Service Pension. On the 28th October, 1868, while at Devonport, he was promoted to be Regimental Lieut.-Colonel, and posted to the 3rd Battalion, still in India. Once more, and for the last time, he went to India to take up his command. He returned to England with the battalion, landing at Portsmouth on 1st January, 1871, and remained at that station until he went on half-pay as a Major-General in the following year. His commission as Major-General was antedated to 23rd August, 1869. He retired from the Service on the 1st July, 1881, with the honorary rank of Lieut.-General. He was created a Knight Commander of the Order of the Bath on the 25th May, 1889, and on the 15th June, 1894, was appointed

* The connection with Kingswood, Surrey, was as follows:—Admiral Stuart's beautiful second daughter, Elizabeth, married Thomas Alcock, formerly of the 1st Royal Dragoons, who, in 1828, travelled through Russia, Persia, and Turkey, including the Caucasus and the Crimea. He was M.P. for East Surrey for many years. Having no children of their own, they adopted their niece, Mary Stuart Nepean, who continued to live at their place, Kingswood Warren, near Epsom, until her marriage at the church in the grounds which her uncle had built.

† Sir Evan Nepean, 1st Bart., married Margaret, daughter of Capt. William Campbell Skinner, R.E., and granddaughter of Lieut.-General William Skinner, R.E., Chief Engineer of Great Britain.

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Colonel of the Durham Light Infantry, in succession to General Sir J. Bisset, K.C.M.G., C.B., deceased.

After a long illness Lieut.-General Sir W. A. Fyers died at his residence in Onslow Gardens, South Kensington, on the 10th November, 1895, in his 81st year. He left a widow, two sons, and an only sister to mourn his loss. The funeral took place four days later. The first part of the service was held at St. Peter's, Cranley Gardens, where he had been wont to worship, Dr. Ridgway (now Bishop of Kensington) officiating. The body was interred at Kingswood, Surrey.

Lady Fyers died in 1900, and was buried beside him.

By his wife, Mary Stuart Nepean, Sir William Augustus Fyers had three sons :—

I. Henry Stuart Fyers, born in London, 29th July, 1859 ; died at Calcutta, 23rd February, 1863.

II. Hubert Alcock Nepean Fyers, born at Simla on the 2nd September, 1862 ; Captain, late Rifle Brigade, M.V.O., Royal Rifle Reserve, 1900 ; married in London, on 15th July, 1897, Evangeline Blanche, eldest daughter (born 4th February, 1876) of Capt. Hon. Francis A. Chichester, 7th Hussars, and Lady Emily Stewart, daughter of Randolph, 9th Earl of Galloway. Capt. Hubert Fyers commanded at Osborne Queen Victoria's last Guard of Honour. In 1907-08 he was aide-de-camp to H.E. Lord Northcote, Governor-General of the Commonwealth of Australia. He has issue :—

(1). Fitzroy Hubert Fyers, born in London on the 13th March, 1899.

(2). Enid Elizabeth Blanche Fyers, born in London on the 5th January, 1902.

(3). Cynthia Armorel Emily Fyers, born in London on the 16th October, 1905.

III. Evan William Hamilton, born at Kingswood Warren, Surrey, on the 7th September, 1864 ; B.A., Christ Church, Oxon., 1887, Lieut., Reserve of Officers, Captain and Honorary Major, 8th Battalion City of London Regiment (Post Office Rifles) ; married in London, on 28th January, 1897, Florence Mary Kent, daughter of David Kent, Esq. (marriage dissolved in 1904). Issue :—Mary Stuart Fyers, born in London 14th May, 1898.

Some of the descendants in the male line of Thomas Fyers, Overseer of the King's Works in Scotland, have not failed to claim their privilege to be enrolled among the Burgesses of Berwick-on-Tweed. As has been already stated, Thomas Fyers himself was enrolled on the 6th December, 1735 ; Lieut.-General William Fyers, his eldest son, on the 15th September, 1786 ; Major-General Peter Fyers, his youngest son, on the 6th November, 1827 ; William Augustus Fyers, son of Major-General Peter Fyers, on the 17th November, 1879 ; and Hubert Alcock Nepean Fyers, grandson of Major-General Peter Fyers, and great-grandson of Thomas Fyers, on the 16th February, 1888.

(*To be continued*).

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MEMOIRS.

MAJOR DAVID CHARLES COURTNEY, LATE R.E.

We have recently lost a man who, for the combination of ability power of hard work and devotion to duty taken together, was probably unequalled in the Corps.

His abilities were high, for although he never occupied any position absolutely of the first rank, yet he was capable of carrying out successfully any work that came to him whatever its nature might be, and was always well informed of the events and movements of the time. In power of work he was unrivalled. He enjoyed it, and never seemed to tire, whatever the subject might be which he had in hand.

He was born on 27th January, 1845, the elder son of Henry Courtney Esq., of 24, FitzWilliam Place, Dublin. He was educated at Blackheath Proprietary School from his 10th year continuously, till he went to Woolwich. He passed 3rd into the Academy in "Watson's" batch, and got his commission in the R.E. on 17th April, 1866.

After about four years at Chatham and Aldershot, he went to Malta for five years. While there he met and married the eldest daughter of the C.R.E., Lieut.-Colonel Gother Frederick Mann, a representative of an old Corps family.

After about three years at home, spent at Dover, he went to the Cape of Good Hope for the Zulu War of 1879, getting his step to Captain shortly after landing. He was posted to the 2nd Company, just converted from "Fortress" to "Field," under Capt. Wynne. The company was sent up at once to the Lower Tugela, and started from there on 18th January, 1879, as part of Colonel Pearson's column, directed on the capital town, Ulundi. On its way it was to form a depôt at Etshowe. On 22nd January the column, while on the march, was surrounded by some 8,000 Zulus. Courtney and the company were employed at the time in mending the drift over the Inyezane River, and part of the main body had passed over when suddenly firing came from all directions. Courtney at once dropped pick and shovel, and extending his men to cover the drift, kept off the Zulus near him for at least half an hour, until he was relieved by the infantry. Colonel Pearson said that Courtney had saved the Column.

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On the 23rd inst. Colonel Pearson's column arrived at Etshowe and began an earthwork. On the 28th inst. news arrived from Lord Chelmsford of the disaster at Isandula, where the 1st Column was wiped out by the Zulus, and Colonel Pearson was told to retire or remain as he thought best.

At the Council of War which followed, Capt. Courtney's voice was for holding on. He pointed out that if they retired Natal would probably be overrun by the Zulus. Nevertheless, a retirement was nearly brought about, when fortunately two senior Staff officers, who had been absent during the first part of the proceedings, returned, and strongly backed Capt. Courtney's views. They were adopted, and the column held on to Etshowe where it remained until April, when it was relieved by fresh troops. The hardships were considerable and caused much illness, but Courtney seemed all the better for them. On the death of Capt. Wynne he succeeded to the command of the company, and after Etshowe served with it in the advance of the 2nd Division on Ulundi, and also with Baker Russel's Column to the close of the operations.

He was noticed during this campaign for the great care he took of his men, and for the way in which he would insist on all tools, etc., being packed away and in their places, even after a hard day's work, so that they were always ready for emergencies.

For this campaign he was mentioned in despatches and received the Medal, with clasp.

On his return from Zululand he went to the Royal Arsenal, Woolwich for three years, during which time his work was much appreciated.

In 1884-5 he saw some more active service in the Nile Expedition. He arrived in Cairo on 4th September, 1884, and was then ordered to proceed up the Nile and report upon possible portage roads to turn the various minor cataracts south of Sawas as far as Hannek, the "Third" Cataract. He had completed this work and sent in all his reports and sketches by the middle of November. In January, 1885, he joined the River Column under General Earle, and was employed on survey work about the "Fourth" Cataract. He was present at the action of Kirbekan, on 10th February, and returned to England in August, 1885.

For this campaign he was mentioned in despatches, and received the Medal, with two clasps, Bronze Star, and Brevet of Major.

A brother officer who saw a great deal of him on the Nile writes:—"He was the most absolutely unselfish companion I have ever been with. On service, when necessaries were not to be got, it was not with him a case of sharing his things with others—he simply gave them away."

After the Nile Campaign he was posted to the Royal Small Arms Factory at Enfield for about a year and a-half.

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At this time the appointment of Assistant Superintendent at the India Store Depôt was offered to him, one of the conditions of holding which was that he should retire from the Army, as the India Office did not wish for a divided allegiance. Although he did not particularly wish to leave the Corps, he nevertheless took the appointment and retired.

It was characteristic of Courtney that although he might have retired with the honorary rank of Lieut.-Colonel, as such a step was at that time given to retiring officers, yet as he did not wish to appear to be of a rank the duties of which he had never exercised, he retained his title of Major. In this way he did not seem quite even with his contemporaries, who from their nominal rank would appear to have had longer service than he.

The following appreciation of his services in the India Store Depôt is supplied by a former Director-General of Stores under whom he served:—

"Major Courtney was appointed Assistant Superintendent of the India Store Depôt in 1887, and retired 1898, on the ground of ill-health, after rather more than 11 years' service. His physical powers were on the verge of breakdown, not only under the strain of heavy official work, but also under that of the extra duties he voluntarily undertook. His devotion to duty was a marked feature of his character; a master of detail, he left nothing of importance to even the ablest of his assistants, but insisted on tackling the most laborious and intricate calculations himself."

"He had a wide knowledge of material, combined with a somewhat rare capacity for appreciating the practical side of production, and these enabled him to revise and systematize the preparation of specifications for the infinitely varied supplies demanded for India, to the great advantage both of the Department and of the manufacturers of Great Britain."

"He prepared many pages combining practical principles with theoretical details, to enable officers in India to prefer demands in such forms as would ensure exact compliance with actual requirements. As an example I may quote his 'Notes on Indents for Pipes and other Stores for Waterworks,' published as Paper VII. of Vol. XXII. in the *Professional Papers of the Corps of Royal Engineers* (Occasional Paper Series), a paper which has become a handbook for the Services in India."

"His goodness of heart prompted many an act of helpful assistance to members of the establishment, over which he exercised so beneficial a control, acts which were never heard of till after his retirement. His work and his example for good remain an invaluable heritage to his successors of to-day."

After the India Store Depôt, Courtney stayed on for a time in London; but he had made up his mind that he wished to live in

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Dublin, where he had landed property, and which used to be his home. Consequently he bought a house at Mill Town, in the environs of Dublin, where he set himself to do all the good he could in connection with anything that wanted helping. Though he specially devoted himself to hospitals, he became Treasurer of the "Veterans' Club," for the benefit of old soldiers, and he was a member and one of the Hon. Treasurers of the City of Dublin Unionist Registration Association. At his death some 15 of these societies passed resolutions of condolence with his family and of appreciation of his services.

A quotation from *The Church of Ireland Gazette*, of December 3rd, 1909, may be given as summing up Courtney's qualities:—"The death of Major Courtney removes from our midst a man whose personal charities were splendid and secret. His soldierly nature made him incapable of self-advertisement, while he gave freely of his means, his time, and his sympathy to innumerable public charities, and contributed with noble generosity to the funds of the Church of Ireland. The loss of one who was in every sense a high type of Christian gentleman, marked by an unfailing courtesy, kindness, and devotion to duty, is greater than can be readily estimated."

On these works he was employed to within a week of his death, which took place suddenly on 28th November, 1909, from heart failure.

One of his sons still carries on the name in the Corps.

J.F.L.

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MAJOR ALAN EDWARD GERRARD WATHERSTON, C.M.G., R.E.

ALAN WATHERSTON was born in London on the 29th October, 1867: educated at Clifton and the Royal Military Academy, Woolwich, and received a commission in the Royal Engineers on the 16th February, 1887.

After the usual two years at Chatham he went to Hong Kong where he was employed on Corps duties until his return to England in 1891. He then went to Aldershot, following this by service in Cairo until he came home to take up the appointment of Instructor in Survey at the School of Military Engineering in 1895.

In 1898 he went to East Africa as Assistant Commissioner of the Anglo-Portuguese Boundary Commission. Two years later he was appointed Chief British Commissioner for the delimitation of the boundary between the French Colony of the Ivory Coast and the British Colony of the Gold Coast. In the following year he was made Director of Surveys of the Gold Coast and Ashanti, and early in 1905 received the important appointment of Chief Commissioner of the Northern Territories of the Gold Coast.

The first eleven years of Alan Watherston's service were much like those of other officers of the Corps. Then, with his appointment as Assistant Commissioner on the Anglo-Portuguese Boundary Commission in East Africa, came his opportunity, and he grasped it with both hands. He threw himself heart and soul into the work, and, what with his technical skill as a surveyor, his organizing powers and his energy, his social qualities—no mean asset in an International Boundary Commission,—and his ready tact and judgment, the value of his work was such that he was appointed Chief British Commissioner in 1900 on the Franco-British Boundary between the Ivory and Gold Coasts.

About this time the question of land leases for gold-mining purposes in the Gold Coast and Ashanti had risen to great importance. For many years prospectors had been at work and European companies had been acquiring properties from the local chiefs. But no reliable survey of the country existed, and when Major Sir Matthew Nathan, R.E., took over the Governorship of the Gold Coast, an extraordinary state of confusion prevailed. Not only were Government officials and mining companies calling urgently for a map to show the position

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of the various gold mines, but such concessions as had been demarcated had been very badly surveyed: boundaries overlapped on all sides, and litigation crowded the law courts. Previous administrators had feared the expense of a general survey: not so Sir Matthew Nathan. Acting with his customary promptness he at once initiated a Survey Department by obtaining for Watherston the appointment of Director of Surveys, leaving the whole system for him to organize and start.

The task was a greater one than it may appear, for, besides the difficulties of a scientific survey of great accuracy in a country of the nature of the Gold Coast, there was the financial and business side of the work. The country is one of dense forest, extensive stagnant swamp, and intolerable damp heat, with one of the most enervating and unhealthy climates in the world. Triangulation was found to be impossible, a new system of survey had to be created, and a staff adapted to both cadastral and topographical work formed. Watherston naturally turned to the Corps for officers and men, but sufficient to form the whole staff could not be spared, and a large number of Australian and New Zealand surveyors had to be obtained by cablegram.

It may safely be said that from the time he started operations in July, 1901, until he left the department at the beginning of 1905, Watherston did not rest for a single day. Besides carrying on the Survey Department, he also continued his arduous work on the International Boundary, for the successful conclusion of which he was created a Companion of the Order of St. Michael and St. George in 1903. No man ever better earned the distinction, for the boundary work included such varied factors as survey, diplomacy, and fighting.

Eight months in the year were spent on the Coast, but the remainder were also full of work for Watherston. The voyages were occupied in compiling returns, making plans for future work, ordering stores, and organizing generally for the next year's expedition. The day after landing, an office was opened in London and draughtsmen set to work on maps and plans while Watherston conducted a series of interviews with directors and secretaries of mining companies, and attended to a great mass of correspondence.

It was only a man of Alan Watherston's energy, common sense, and great business capacity who could have carried through such strenuous work in the successful manner he did. He was not possessed of the best of health—the climate was telling on him. Many a time did he turn in at night with an attack of fever with his temperature up to 104, and arrive smiling at his desk at 7 o'clock the next morning. His indomitable will pulled him through the day until the evening often brought another attack.

Besides his qualities as a worker, Watherston possessed many others that brought him the affection and loyal support of his staff.

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His social disposition, his cheery infectious laugh, his ready advice and help, and his sporting inclinations, gained him a host of friends and made him welcome everywhere, especially in the deadly depressing climate in which he spent so many years.

In April, 1905, he was made Chief Commissioner of the Northern Territories of the Gold Coast, a Colonial Office appointment which foreshadowed future distinctions. Again he threw himself heart and soul into his work, and his manner of governing this great block of country proved that he was an ideal Chief Commissioner. He had a big task in front of him—that of altering the government from a military to a civil basis. This he successfully accomplished, and then began developing the natural resources of the country. But he had already suffered several times from "blackwater fever," and it was only his characteristic pluck that enabled him to go on with his work.

On his return home in 1908, Alan Watherston was married, and the large gathering of old friends and brother officers who were present little thought that it was the last time many of them would see him. He returned to the Northern Territories at the end of the year and took up again the reins of government.

The climate, however, would no longer be denied, and he, no more than others, could escape the penalty of long residence in a remote and unhealthy region. To the grief of all who knew him, Alan Watherston died of fever at Tamale, his seat of government, on the 12th December, 1909.

He died, I think, as he would have wished to die—in harness.

F.G.G.

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TRANSCRIPTS.

RECONNAISSANCE AND SKETCHING.

By MAJOR A. H. D. RIACH, R.E.

Transcribed with the kind permission of the R.U.S.I. of India from a lecture delivered at Ahmadnagar on 28th June, 1908.

"*A commander without information is like a man blindfolded; he knows neither where to strike, nor from what quarter to expect attack.*"

"*The acquisition of accurate information is one of the most difficult tasks of a commander in the field.*"

"*Unless he can pierce the* fog *that surrounds his adversary, he will be unable to devise a scheme either to compass that adversary's overthrow, or to ensure his own safety.*"

"*Reconnaissance is usually understood to mean the acquisition of information about an enemy, or about a country, by personal observation.*"

"*It is by means of reconnaissance chiefly that a commander endeavours to ascertain the numbers, disposition and movements of his enemy, and to obtain such detailed information about the theatre of operations as may be necessary to supplement the maps at his disposal.*"

The foregoing are extracted from "Art of Reconnaissance" by Colonel Henderson.

Now information about ground can be best conveyed, and in many cases only conveyed, by means of sketches, and the inability on the part of a scout, or the officer commanding a patrol, to produce an intelligible sketch, may prevent some most valuable information gained by him from being understood and made use of by the commander. No skill in word painting can make up for ignorance in this most useful branch of military training. It is therefore the duty of every soldier who can read and write and understand a map, to pick up the rudiments of this art.

This does not mean that everyone should be able to produce an accurate and neatly executed map or a picturesque sketch. To again quote:—

"Mapping which is frankly inaccurate, and pretends only to give, in reasonable proportion the main features of a district, can nearly always be carried out, and is often of great value. Maps drawn roughly by eye with perhaps a few compass bearings as guides, or maps sketched in from memory, after the ground has been crossed and observed, may, and often do, present exactly the information which is required."

To prepare such a sketch is within the capacity of anyone who has read the elements of field sketching. It is merely a matter of practice, of eye, of appreciating the features of the ground it is necessary to put

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on to paper, and of hand, in being able to draw a reasonably firm line. *Anyone* can learn to do it, but it is harder for the man who has not inherited the knack of using his pencil. My object is to show what may be done by an inferior draftsman, and the great utility, in certain circumstances, of even a poorly executed plan or panorama.

To have had a sound training in field sketching is a great help, but the means employed to produce a sketch which will win a star in "C" can seldom be fully made use of in the face of the enemy. Pacing, contouring, taking slopes with the clinometer and filling in detail in a triangulation made with the plane table or compass, are generally out of the question. These are the methods by which one learns, and they bear the same relation to the reconnaissance of an enemy's position, as the exercises learnt in the barrack square do to the attack on that position. Just as, without the preliminary drill which has taught us to march and turn to close and extend as matters of *habit*, the best of material will be of little use in the rush and excitement of attack, so in the same way without the habit of seeing, noting, measuring and putting on paper, slopes, angles, and features of ground, the best artist in the world will often fail to produce a reconnaissance sketch which will be of value to the commander of an attacking force.

What is required in reconnaissance is, first, to note the things which will be of use, and, secondly, to make the facts learnt available. If to do this requires that a sketch be prepared (and this will usually be the case in an attack), then that sketch should embody just what is wanted, and no more.

It should be the best possible "fudge" which can be made in the time available; and the time available is, generally, the shortest possible time.

Now to execute a "fudge" one naturally makes use of any means at hand to help. Such means, in the case in point, usually exist in the form of maps of some sort. The task then is often to verify and add to the details on the map, so as to give the commander definite knowledge as to the accessibility of his objective, and the routes available.

If you have a map, use it fully, if not do the best you can to supply the want.

The most usual maps available are small scale ones, and to add the essential detail they have to be enlarged.

I have dismal recollections of the topographical sketches one had to execute as a cadet, pacing solemnly along a road, marking the direction of every fence, the size and exact position of the pigsty (with a note "pigs invisible, probably two or more"), and other details of equal value. A rate of progression of a mile an hour was good, and if after a hard morning's work one had gone round the sides of a square mile of country, one had done well, even though prominent features of tactical importance lying close to the route had been put in in a most shadowy manner, because time had not sufficed to take accurate shots at them in the way laid down in the textbooks.

The futility of much of this work, and the false ideal it set up, has at last been recognized—*vide* "General remarks" in *The Manual of Map Reading and Field Sketching*.

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2. "A military map or field sketch should show all the features of, or in, a country, natural and artificial, which are of importance from a military point of view, *i.e.*, those which might affect the dispositions, movements, security, or supply of troops. A military *map* is the proper work of a trained *surveyor*, using special instruments and elaborate methods, with unlimited time at his disposal, and aiming at minute accuracy. A field *sketch* is a sketch of ground such as any officer or non-commissioned officer, of average attainments, ought to be able to make, working with such instruments and under such conditions regarding time, weather, etc., as generally exist in the field. Therefore, while every effort should be made to be as accurate as time and the means available will permit, that minute accuracy which is required by the *surveyor* in the production of his map is not expected, and should not be attempted."

For field sketching, as opposed to mapping or surveying, rapidity is essential, and with it intelligibility, clearness and simplicity; accuracy is a minor consideration. It is all a matter of judgment plus previous training.

As I have said, a sketch should be the best "fudge" that can be made under the circumstances. I qualify this by adding that it must never be a "*fake*."

Everything on the sketch should exist, and if some important detail has been sketched in approximately by eye, a note to that effect should be added.

Instruments are of assistance only so far as they will help to produce the result aimed at. A ruled line is unnecessary when you can draw a sufficiently straight one freehand. A measured angle is needed only when you require the point observed as a "Ruling point" to form the framework on which you have to build up your sketch. In short, use your instruments as you should use an orderly and don't *make* work for them.

To return to our examples and the means of producing a reasonably correct sketch in limited time, under possible fire, and with but little in the way of appliances :—

Sketch 1 explains itself (see *Plate*). It was produced from the pocket handkerchief map and is an enlargement made on squared paper, such as one has in the Service note book, Army Book 153.*

What we need are—board or card to sketch on, paper, pencil, knife, rubber, compass, straightedge, and perhaps chalks.

The framework should be built up in the following order :—Roads and ruling points such as hills, villages, water courses, and lastly form lines.

Using squared paper enlargements, sketches can be done in sections and joined together.

Sketch 2 is the finished product, not very highly polished but something like what could be done under the conditions. The route followed is shown, and practically every line on the sketch (except a few tracks) can be seen from this route. It lies for a great part out of sight of the enemy and is almost entirely out of rifle range.

* *Note.*—The "Memo" on the title page of this book and the note on p. 66, *The Manual of Map Reading, etc.*, as to the size of these squares are both incorrect.

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Note differences between 1 and 2 such as correction of position of Shahpur village, addition of East Ridge Barracks, etc., and extra form lines.

On reaching A, Sketch 3 was roughed in, and finished up after return.

It is popularly considered that to draw a landscape sketch is beyond the capacity of anyone, not an artist, without long and wearisome training. *This is not so.*

Many books give useful hints as to how to proceed. The frame, recommended in *The Active Service Pocket Book*, is likely to be an assistance to the learner. *The Manual of Map Reading, etc.*, devotes a chapter to the subject, and gives examples, but they rather frighten the beginner by their excellence. Read the instructions and try for yourself.

Personally, I recommend the following procedure for a "stiff 'un" with the pencil:—

1. Decide what you want to draw, and from what point.
2. Decide length of panorama.
3. Select prominent distant points, such as hilltops, villages, etc., etc.
4. Estimate roughly (or measure) total angle included, and angles between each pair of prominent points.
5. Using squared paper, select on it the number of squares you wish to represent the above angles, and tick them off. (In Sketch 3 one large square of 1″ represents 10°, and the sketch includes about 80°. Taking the nek as the centre, the tomb is 10° left, and One Tree Hill 5° right. Peak B is 14° left of tomb, peak C 15° left of B).
6. Next decide maximum height of sketch, angularly, from highest peak to nearest point of foreground it is intended to show, and also vertical angles of one point above another, and tick these off on the squared paper.
7. In this way, starting with sky line, or else the most prominent line you wish to depict, jot in the lesser features in their proper positions, and, so far as you can, at the proper size.
8. Unless the foreground is of tactical interest (it seldom is?), *leave it out.* Also shading, unless you mean something by it and are able to do it fairly well. Show forests and trees, ridges and spurs, lines of roads, etc., as well as you can.
9. Label the prominent important points, and, if you can, take or estimate ranges to them, and note on sketch.
10. Don't exaggerate hills too much, but clearly show all important villages, knolls, etc., even if not really very conspicuous. Show courses of nullahs as far as possible, by labels.
11. Fake in nothing.
12. If you have a plan, the panorama should be referred to it, *and the point whence taken marked on it.* If not, give a rough plan diagram to show where you sat, and put a north point.

If you have no squared paper, or your map itself is not marked off in squares, then, instead of drawing them, a more rapid method of making an enlargement, or a copy, is as follows:—Suppose the enlargement is from 1″ to 1 mile to 2″ to 1 mile, then on the plan describe a circle somewhere in the middle of the piece to be enlarged, and from its centre

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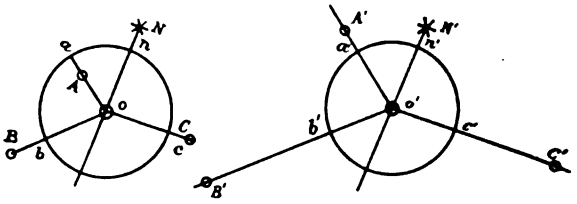
O draw rays to the prominent points, as A, B, C, and another ray to mark the direction of the north point N.



These rays cut the circle at *a*, *b*, *c* and *n* respectively. On the blank paper describe a similar circle and draw the north point N′, cutting the circle at *n′*. Measure *na* and lay off *n′a′* on the other circle. Similarly make *a′b′* and *b′c′* equal to *ab* and *bc* respectively.

Draw rays through *a′ b′* and *c′* from centre O′. Set off O′A′ along O′*a′* and make it equal to twice OA. Similarly make O′B′ and O′C′ equal to twice OB and OC respectively.

The points A′ B′ C′ will then be plotted correctly on the enlargement, and the intermediate detail can be filled in by eye, as when using squared paper.

This takes a lot of description, but in practice it can be done very quickly, and is simple and accurate. If no compasses are available, draw the circles by making two holes in a card. Put a pin in one as the centre and describe the circles with a pencil point in the other hole. Use the edge of the card to measure and lay off the necessary lengths.

The best time to see a landscape is when the sun is shining across it, and is not directly behind your object or yourself.

Like the plan, the preliminary work of the landscape sketch may be done beforehand. The drawing of panorama sketches from the map alone, as now taught, must bear the same relation to a sketch drawn on the ground, as Plan 1 does to Plan 2.

The measuring of angles has been referred to, but to do this with a compass may take too long, except for the preliminary skeleton of the plan. Now, if the distance to the eye from an object held in the fingers with the arm extended is 28½, (as is the case with many people), then a ruler graduated in inches will cover 2° per inch, if so held out, and viewed with one eye. A four-fold, 1′ rule is easily carried, and can conveniently be used in this way. Opened to 6″ it will subtend 12°; to 12″, 24°; angles, vertical and horizontal, can thus be quickly estimated. Each individual should test this for himself, and see what correction is necessary.

The span of the open hand, with arm extended, covers from 16° to 19°, the palm 6° or 7°, one finger 1° to 2°, and so on. These should be tried and learnt.

The angle viewed without moving the eyes is roughly 60°.

As regards scale for plans 2″ to 1 mile is convenient for open, and 3″ to 4″ per mile for close country is useful.

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Note north point always. Finishing up in ink is often better than pencil. Printing, as on Sketches 1 and 2 with long-tailed letters is recommended, as it is easier to make this look straight and even:—

AHMEDNAGAR

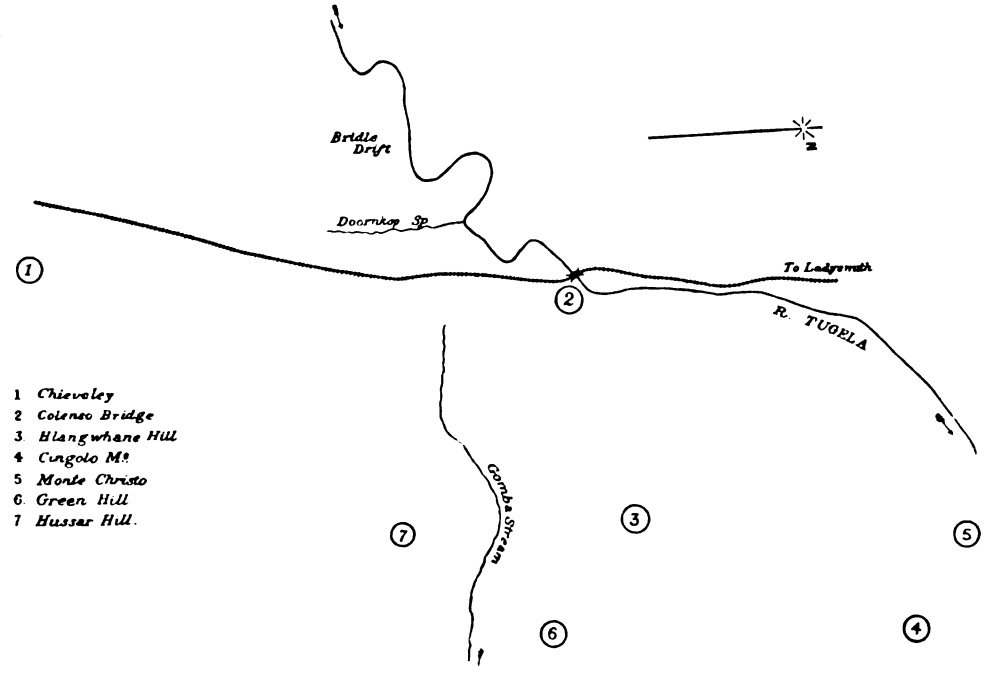
If you have no instruments, make an eye sketch; if no map then try and get some framework and a base to work on. Pace, use milestones or telegraph posts, or take range with range-finder.

A plan sketch made from one point with a range-finder and a compass, with intermediate detail filled in by eye, may be exceedingly useful.

Is the advantage to be gained ever worth the trouble, on active service? Will not a simple freehand diagram be sufficient and easier to understand?

I reply with a question: "If you were called on to attack the position delineated in Sketches 2 and 3, not having seen the ground, what course of action would appear to you likely to be suitable?" The obvious answer is "hold the enemy in front, and turn his left flank."

Now as no battle is known to have been fought over this ground, and as an ounce of practice is worth pounds of theory, let us take examples from history. Our sketches serve very well to illustrate a piece of ground which was much in our minds a few years ago. The numbers in the following extracts refer to the numbers in circles and letters on Sketch 2, as can be realised by reference to the following Skeleton Key. The Difference of North Point however should be noted.



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Extract from orders by Lieut.-General Sir Francis Clery, K.C.B., Commanding South Natal Field Force :—

CHIEVELEY,
14th December, 1899, 10 *p.m.*

1. The enemy is entrenched in the Kopjes north of Colenso Bridge. One large camp is reported to be near the Ladysmith Road about 5 miles N.W. of Colenso. Another large camp is reported in the hills which lie north of the Tugela, in a northerly direction from Hlangwhane Hill.

2. It is the intention of the G.O.C. to force the passage of the Tugela to-morrow.

3. The 5th Brigade will move from its present camping ground at 4.30 a.m. and march towards the Bridle Drift, immediately west of the junction of Doornkop Spruit and the Tugela. The Brigade will cross at this point, and after crossing move along the left bank of the river towards the Kopjes north of the Iron Bridge.

o o o o o

General Hart, Commanding the 5th Brigade, had been provided with a tracing of a map, a Kaffir guide, and an interpreter to assist him to find the "Bridle Drift."

The map was a plane table sketch prepared shortly before the action, an attempt to fill into a farm survey, made for land registration, as many of the topographical features as could be seen from a distance. It had not been verified by close reconnaissance of the river and both the sketch and the orders were misleading. The sketch was defective in three particulars; it showed the Spruit as running into the Tugela at the west bend of the loop, the Bridle Drift close to the junction of the Spruit, and also another loop of the river, west of the drift.*

Hart's Brigade of Irishmen were led straight into the loop, fought their way up it with loss; found no drift, (though it afterwards transpired that there were two available) and after some hours were recalled and fell back, growling and unbeaten, ready to go for the enemy again if they could.

The attack on the Iron Bridge was mown down, Long's guns, unable to get fresh supplies of ammunition, were finally abandoned, the attack round to the right was recalled, and the Battle of Colenso was lost.

Does this not show the usefulness of efficient reconnaissance sketches? It may be said the disaster was entirely due to the lack of such. We are told that Sir Redvers Buller was for some time under the impression that the Tugela ran to the south of Hlangwhane (*i.e.*, along the line of the Gomba Stream), and that this misunderstanding modified his whole course of action.

It is as though the officer who filled in Sketch 2 had failed to push forward as far as the route shown on the plan, and knowing a deep river flowed across his front, had shown it quite incorrectly at F, and also as following the line of the nullah from Shahpur, past Sarpola Hadi.

* "Official History of the War in S. Africa, 1899-1902," Vol. I.

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The utility of the panorama sketch was again well illustrated by a sketch executed by two R.A. officers, with a range-finder which showed the true position of Hlangwhane, relatively to the river.

After Colenso, which was fought on 15th December, 1899, came the Acton Homes, Spionkop, Vaal Krantz Campaign, and it was not till the middle of February, 1900, that Buller decided to try *viâ* Hlangwhane.

Here again he was hampered, and lost time, for want of proper reconnaissance sketches. The official history, referring to their series of actions,* says that Sir Redvers Buller either gave verbal instructions to his generals, or supplemented written orders by oral explanation. This was on account of the difficulty of describing in writing the features of this hilly country. It had been surveyed, but solely with a view to settling the boundaries of farms, and the map hurriedly compiled from these farm surveys often misrepresented or wholly ignored the military features of the ground. Great efforts had been made to correct the defects, but the only information obtainable was not that of soldiers trained to study country from a professional standpoint. The map, though far better than none at all, was frequently very misleading.

The difficulty was increased by the absence of landmarks, by which the ground could be described.

Moving from Chieveley (1), *viâ* Gun Hill, Buller re-occupied Hussar Hill (7). Thence he reconnoitred Green Hill (6) and in succession captured this hill, Cingolo Mountain (4), Monte Christo (5) and Hlangwhane (3). Pushing on to Naval Hill he bridged the river and fought his way to Ladysmith.

One more remark :— It is often our duty to check the survey maps of large tracts of country, and this is a task imposed with the definite object of ensuring that these maps will not play a commander false, as Buller's maps did. Bearing this object in mind, and regarding the work as an exercise in reading ground, as a soldier is required to do, tactically and strategically, the irksomeness will be at least decreased. If in addition we look on the result of our labour as a record, the falsity or inaccuracy of which may lead to loss or disaster in actual warfare (it is conceivable that officers were employed in peace time verifying plans of Natal),† we shall then be willing to put our best into the performance and carry it out with interest.

* Vol. II., p. 435.
† [They were not.—Ed.].

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REFORMS IN THE RUSSIAN ARMY SINCE THE WAR IN MANCHURIA, WITH A NOTE ON THE NEW RUSSIAN FIELD FORTIFICATION MANUAL.

(Adapted from the *Revue Militaire des Armées Étrangères* and the *Kriegstechnische Zeitschrift* by 2nd Lieut. A. H. SCOTT, R.E.).

IT was not till soon after the Russo-Japanese War that the Russian Army assumed a really national character, thanks to the law of the 20th March, 1906, which reduced the time of active service to three or four years. This law allows of men being passed more rapidly through the active army, and of more men being trained than formerly. Moreover, the peace establishment of the army has been increased from 320,000 to 456,000, and in a few years Russia will have at her disposal from five to six million trained men.

Not only have the methods of recruiting the army, but also its organization, administration, and system of training been changed. The cost of these reforms was estimated by Count Witte, in a speech made by him to the Council of the Empire, at 200 million roubles.

The details of the changes which have been made up to September, 1909, are as follows :—

(1). *Organization of the Higher Commands and of the General Staff.*—The principle of placing all important billets of the army in the hands of members of the Royal Family had—previous to 1906—caused the absolute necessity of unity of thought and action between the higher commanders and the War Office to be completely forgotten. Thus the "Council of National Defence" and the artillery and engineer inspections were under the direction of royal Grand Dukes, and, to all intents and purposes, independent of the War Minister and his department. In 1905 the Inspector-General of Infantry was instituted, and placed under the direct control of the War Office, and in 1908 the artillery and engineer inspections also came under his control. Since then the two latter inspections have been subdivided, the troops and technical services having been placed under different commanders in each case; all are however under the War Minister. The "Council of National Defence" has been abolished. This abolition is only temporary; it will soon reappear under a different organization. In 1905 the General Staff was likewise serving two masters—the Chief of the General Staff and the War Minister; but since 1908 this state of affairs has ceased to exist.

(2). *Officers.*—After the war public opinion largely exaggerated the share of the defeat due to the corps of officers as a whole. Their consequent unpopularity, the poor pay they received, the somewhat

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irregular rules of promotion, the privileges granted to officers holding administrative billets, to those on the General Staff, and to those in the Guards in the matter of rapid promotion, all combined to make a military career unpopular. In 1906 matters came to a head, the deficit in officers having got as high as 18 per cent., and steps were taken to remedy this state of affairs.

The system of promotion in the Russian Army is one of certificates, which are sent up by officers to a committee, the composition of which varies with the rank of the officer to be promoted. The advantages which used to be conferred by the passing of divers courses, have now been abolished. Few officers are promoted out of their turn, and seniority lists have been drawn up for each army corps in the case of the infantry, and on the whole arm in the case of the other branches.

The pay of officers has been slightly increased, field training allowances have been instituted, and more garrisons than formerly now confer on the officers stationed in them the right of drawing lodging allowance. In addition to this an increased rate of pensions has been in force since the 1st January, 1909, and the restrictions to officers' marriages formerly existing have been almost entirely done away with. Now the bride-elect has only to meet with the approval of a court of honour, composed of the officers of her future husband's regiment, or, in case of appeal, with his commanding officer's approval. No officer is however allowed to marry before the age of 23.

The number of schools of "Younkers" has been reduced from 13 to 9. These schools correspond to the French establishments of St. Maxient and Versailles, *i.e.*, they train intelligent N.C.O.'s for the commissioned ranks. The number of "Military colleges" has, on the other hand, been increased from 6 to 10. These schools correspond to our R.M.A. and R.M.C.

A manual on the duties of officers has been published, and lays down the duties of all ranks, the chain of command, and the degree of initiative expected of subordinate officers. It attaches special importance to the practice of war games in winter and of field exercises in summer. It further indicates the duties of staff officers in these exercises.

In order to prepare officers for the command of a fire-unit in the field, all Second-captains who are due to command an infantry company, are obliged to go through a course of musketry and field firing. Commanders of companies have to go through a similar course at the School of Musketry before attaining the rank of battalion-commander.

Similar courses exist for the artillery.

(3). *Mobilization.*—The mobilization scheme in force in 1903 dated from 1891. A new scheme was devised in 1907, but having proved unsatisfactory, the old one has been reverted to. Improvements can, however, be shortly expected.

The organization of the depôt battalions, which proved so unsatisfactory in 1903, has been revised. These battalions are now allotted definite regiments, which they have to supply with recruits, and they are also brigaded, one brigade to each army corps.

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(4). *Training.*—The "Training Committee" have decided, after much deliberation, to issue only one manual, which will be divided into five parts, viz. :—General Rules; Infantry; Cavalry; Artillery; and Engineers. "General Rules" will include the manual on the duties of officers, which has already been referred to above, and also different circulars on the development of the spirit of initiative which have been issued from time to time. The Cavalry and Artillery Regulations have not as yet been published; the first part of *Regulations for the Special Training of Engineer Units* is gone into in detail in the appendix.

As regards the infantry, the books issued so far are *Infantry Training*, 1908, *Musketry Regulations*, 1909, and the *Fieldworks Manual of the Infantry*. A handbook entitled *Instructions for Battle*—which was to complete infantry training, give details on the formations to be adopted on active service, and also on the adaptation of the fundamental principles to suit different occasions—has, however, not been published as yet. All these new regulations insist on the importance of impressing on every soldier that he must use his common sense on all occasions, and, where necessary, take the initiative.

Two subjects, to the importance of which the war has drawn particular attention, are field fortification and signalling. Two systems of signals are used, the one alphabetical, and the other one of abbreviations. The latter must be known to everybody except recruits; the former is only learnt by officers, N.C.O. scouts, and eight other men per unit. The last manœuvres have shown the practical value of these systems and the high standard of efficiency of the Russian Army in this means of communication.

Special attention is devoted to the physical training of both officers and men, and in most regiments the methods of the "sokols" of Bohemia are employed, in addition to the obligatory Swedish gymnastics. Since 1909 a high school of gymnastics has been formed, which trains 100 officers per annum in both gymnastics and fencing.

(5). *Arms and Matériel.*—The Russian rifle of 1891, calibre 7·62 m.m., was used in Manchuria, and gave rise to no complaints.

The 1902 field gun has all the modern improvements. Long recoil and a shield and panoramic sights will soon be added. It is curious to note that, even after the lessons they received at the Yalu and at Wafangu, the Russian artillery is by no means anxious to have shielded guns. This gun has been introduced since the war, during which the 1900 model was employed. The 1907 field howitzers are quite up to date, but nevertheless both they and the mountain artillery equipment are to be replaced by quicker firing guns.

All infantry regiments possess a machine-gun section of four Maxims, which are either carried on pack animals or have a carriage. Each cavalry regiment is equipped with two Mardson machine guns. The number of tools carried by the infantry has been increased since the war; a company now carries 140 shovels, 30 picks, and 30 axes.

A matter of technical organization, in which the Russian Army is really in advance of most other armies, is the organization of communications in the field. The various army corps are united by means of the telegraph

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troops; further communications are carried out by means of telephones—which are manipulated not by the engineers, but by the troops themselves, and which are centralized in each infantry division. Each division possesses 45 kilometres of line and one central station.

(6). *Clothing and Equipment.*—After a large number of experiments in 1908, a grey-green uniform has been adopted, and has proved to be quite invisible at the last manœuvres. This year a reversible coat, green one side and khaki on the other, has been tried.

(7). *Administration.*—Since 1908 the Ordnance Department has taken over the furnishing of linen, clothing, and footgear to the troops—articles which had previous to this date to be manufactured regimentally.

Such are, up to September, 1909, the reforms which have taken place in the Russian Army, as a direct result of the Manchurian Campaign. It is extremely probable that before long still more important changes will take place, viz., the redistribution of the troops all over the Empire, the reorganization of the system of defence on the eastern frontier, and a more modern mobilization scheme; but as yet no official indications of these changes have been given.

APPENDIX.

THE NEW RUSSIAN FIELD FORTIFICATION MANUAL (PART I.).

(Taken from the *Kriegstechnische Zeitschrift*).

This manual was issued in the summer of 1908, contains 204 plates, and is divided into seven chapters and ten appendices.

Chap. 1 gives details on the various types of fire trenches, communication trenches, and shelters for machine guns; enumerates the advantages and disadvantages of each type, and the kind of country it is suited to.

All types of machine guns in use are mentioned, and the cover they need, either if used as a battery or as single guns in infantry fire-trenches, is described, a special feature being the description of an emplacement for four guns placed in a free space in front of the general firing line.

Chap. 2 deals with the protection of artillery, the erection of observation posts for battery commanders, the cover for the ammunition wagons, the preparation of the means of approach to artillery positions, and tactical considerations affecting the choice of an artillery position are given.

It includes plates showing the type of emplacements required for all Russian guns—76-m.m. Q.F. of 1900 and 1902, 76-m.m. Q.F. mountain gun, 12·2 and 12-c.m. howitzers, and the 152-m.m. field mortar.

Chap. 3.—The fortification of points of support, *i.e.*, the building of redoubts, of posts of observation, the improvement of existing communications and overhead cover. The methods to be employed on commanding ground at the edge of a wood and in rocky or marshy ground are also gone into.

Chap. 4.—Sanitary and watering arrangements in a semi-permanent position.

Chap. 5.—The improvement of existing cover. Four examples are given, viz., the defence of a wood and of German, Russian, and Chinese villages.

Chap. 6.—Artificial obstacles—chiefly wire entanglements, land mines, fougasses, and inundations, which, according to the manual, will not often be used in field operations.

Chap. 7 deals very practically with the invisibility of all fieldworks, and recommends the use of "sham" gun positions.

The Appendices contain tables on the resistance of materials to penetration, extracts from the range tables of various guns, and other such data.

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NOTICES OF MAGAZINES.

ELECTRICAL REVIEW.

7th January.

LARGE INDUCTION COILS.—Examples are given of a large induction coil which gives a 51″ spark with a current of 25 ampères in the primary circuit. The secondary winding is made of different gauge wires, the heavier sections being used as the winding approaches the ends.

PHYSICAL SOCIETY'S EXHIBITION.—Fool-proof galvanometer with suspended moving coil. Direct reading Wheatstone bridge. Resistances are arranged in dial form and there are no loose plugs. Dudell oscillograph and thermogalvanometer.

FUEL SUPPLY CONTRACTS ON HEAT UNIT BASIS.—Samples are taken during delivery, and payment is made not for tons received, but for the heat units according to a prearranged formula.

28th January.

ENAMEL INSULATION FOR WIRES.—This enamel is not melted by heat, and is said to stand temperatures of 300° F. to 400° F. for several hours without damage. It is not affected by weak acids and alkalis. Its insulation resistance is twice that of rubber. A great advantage is the great reduction in space compared with cotton or silk insulated wire.

A. E. DAVIDSON.

REVUE DU GÉNIE MILITAIRE.

October, 1909.

THE FLIGHT OF BIRDS.—The writer shows by mathematical calculations that a bird or aeroplane which flaps its wings, will remain in the air longer than one that merely glides. These calculations do not assume the existence of any valves in the wings. In the same way, a floating plank that has not sufficient buoyancy to support the weight of a man, will nevertheless support him if he dances upon it instead of standing still.—*To be continued.*

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THE ORGANIZATION OF MINES IN A FORTRESS.—This article begins with a description of the Russian countermines at Port Arthur, taken from the *Eenzhenernee Zhoornal*. No work had been done before the commencement of the siege. If any system of countermines had been designed it was not available, as all the plans of Port Arthur were with Kuropatkin's field army. The Russian engineers were unwilling to commence any countermines, as they believed that the fate of the fortress would be decided before the galleries could be driven to any effective distance. Finally, when a beginning was made, the Japanese had driven their saps and mines too close up to the forts for the countermines to cause them any serious delay. At Kikwan North Fort the Russians began two countermine galleries. Through some miscalculation one of these came to the surface of the glacis a short distance from the crest. To remedy this a shaft about 14′ deep was sunk a little distance back, and another gallery was started. When it was estimated that the Japanese gallery had come within about a yard of the Russian gallery, the countermine was charged with 80 kilogrammes of powder and fired. The Japanese gallery was destroyed, but the explosion also laid bare the concrete roof of the counterscarp gallery. The Japanese at once established themselves in the crater, breached the counterscarp gallery, and drove the Russians out of it. The other countermine gallery at Kikwan North did not come sufficiently near the Japanese gallery to be used effectively. This countermine was charged and fired four times. On the first occasion it failed to damage the Japanese in any way. The second charge destroyed part of the counterscarp gallery wall, the third did considerable damage to the Japanese saps, but the fourth destroyed the counterscarp wall altogether. A certain amount of countermining was done at Hatchimaki, Ehrlong, and Long-shu-shan, but none of these mines were charged or fired.—*To be continued.*

J. E. E. CRASTER.

REVUE MILITAIRE DES ARMÉES ÉTRANGÈRES.

October, 1909.

LEGISLATION AND THE ITALIAN ARMY, FROM JANUARY, 1907, TO OCTOBER, 1909.—Since 1906 there have been, especially in the military periodicals, numerous articles in the Italian papers pointing out to the Italian public both the backward state of the army and the ever-increasing *matériel* and *personnel* which Austria was accumulating on the eastern frontier. It is undeniable that, at the end of 1907, the Italian Army was not in possession of Q.F. field guns with which most other European armies were at that period equipped, that the system of fortifications on the N.E. frontier was quite insufficient, and, in many places, left the country at the mercy of an Austrian invader, and that there was at that time a species of "moral crisis" taking place in the army. As a result, the

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complaints of officers, and especially of N.C.O.'s, were listened to less absent-mindedly than hitherto, both in political circles and by the press. In February, 1906, an article by General Biancardi, "Our Artillery-less Army," caused a lively discussion in the press on the state of the army. In February, 1907, the War Minister announced in Parliament that he had been for some time in private treaty with the Krupp firm, and had given them an order for 39 complete batteries of 75 m.m., and for 68 batteries to be completed in Italy. This announcement was received somewhat coldly by Parliament, who objected to the contract having been made without any reference to it, and finally a Commission was appointed to enquire into the following points:—(1), To decide if the existing military organization was sufficient for the requirements of the country, and duly proportional to its economic resources; (2), to settle if this organization yielded a maximum result with a minimum effort: (3), to find if Italy could concentrate on her frontiers as many troops as possible in a minimum time; (4), to see if the frontiers were sufficiently protected; (5), to look into the question of armaments, especially the question of artillery *matériel*, both for the coast and fortress artillery, as well as for the field artillery, and to enquire whether an increase of power could be attained by that arm were it provided with newer weapons; (6), to see if the auxiliary services were well organized; and (7), to discover if any savings could be effected without hurting the value of the military organization.

The Commission was composed of:—Six senators, including a former War Minister: six Members of Parliament, including the Vice-President of the Lower House and three former Ministers or Under-Secretaries of State; and five State Councillors, including Admiral Bettolo, Chief of the Naval General Staff, and M. di Broglio, President of the Audit Chamber.

The Commission decided to examine matters on the spot as far as possible, and subdivided itself into several sub-commissions, each of which had a definite portion of territory allotted to it.

With regard to the artillery, the Commission was present at the practice ground of Cirié, near Turin, at a series of trials of the new Krupp gun (selected by the War Minister), of a Creusot gun, and also of an Erhardt gun.

The Commission made the result of its enquiries public by means of reports.

The first report, published in May, 1908, dealt with:—The defence of the frontiers. The Commission considered this insufficient, and asked for 140 million francs for the reorganization of land defences, and 50 million for that of coast defences. It also recommended that the garrisons of the infantry regiments on the northern frontier, and in ports, should always be the same. Finally, it agreed to the increase in pay of officers, and to their promotion by the time system; it approved of divers ameliorations that had recently been made in the conditions of service of N.C.O.'s, and it demanded an improvement in the food of the troops.

The second report, published in June, 1908, dealt with the artillery question. The Commission pronounced itself in favour of the Krupp

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guns, but commented on the divers transactions that had taken place between that firm and the War Office from 1899 to 1906, declaring that they had led to the adoption of an insufficiently studied equipment, the cost of which was too great for Italy.

The third report, published in December, 1908, dealt with the organization of the army generally, and asked for the simplification of the administration.

A series of less important reports appeared in May, 1909, dealing with:—(1), The recruiting of the army; (2), the length of service; (3), the reorganization of the administrative branches; (4), the question of remounts; (5), the question of clothing; (6), the reorganization of the veterinary department; (7), certain modifications necessary in the disciplinary regulations; (8), the abolition of the "military dowry," which every officer has hitherto had to have before he was granted leave to marry.

The powers of the Commission ended legally in June, 1909, but, on the recommendation of the President of the Council and of the War Minister, they were extended for one year, *i.e.*, till June, 1910. The decisions of the Commission have been made law, from time to time, by the various War Ministers who have been in power since it first sat. Before studying in detail the improvements which have taken place in the Italian Army as a result of its enquiries, however, it is necessary to examine the variations in the Army Estimates between the years 1907 and 1909.

The Italian Army Estimates are divided in two parts—the "ordinary estimates," for the foreseen expenses of the army during the ensuing year, and the "extraordinary estimates," to meet unexpected demands for money during the year.

The following are the "ordinary estimates" for the years 1907—1911:—1907—1908, 270 million francs; 1908—1909, 285 million francs; 1910—1911, 296 million francs.

The "extraordinary estimates" between the years 1906 and 1917 have been voted at 465 million francs, of which 150 million are to be devoted to the re-arming of the field artillery, and 200 million to the reorganization and construction of permanent works.

Modifications in the Organization of the Army.—(1). Alpine Troops.—Three new companies have been created. There are now 78 companies, organized in 8 regiments (26 battalions), instead of 75 companies, organized in 7 regiments (22 battalions).

2. Cavalry.—The twenty-four 6-squadron regiments have been reorganized into twenty-nine 5-squadron regiments; this allows an increase to be made in the independent cavalry (4 divisions of 2 brigades each). The squadrons of the cavalry division are 150 strong; those attached to army corps, 110.

(3). Mountain Artillery.—Nine new batteries have been added to the 15 already in existence. A second mountain artillery regiment has been organized, and when the new 65-m.m. equipment has been distributed to all the units, they will probably be reorganized into 4-gun batteries, instead of 6, as at present.

Improvements Made in the Condition of Officers.—The main causes of

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complaint at the beginning of 1907 were:—(1), The "block" in promotion; (2), the fact that the pay of officers was too small to face the ever-increasing cost of living in Italy. In July, 1909, a law was passed that all lieutenants were to become captains after 15 years' service, even if there were no vacancies; the surplus of captains to be compensated by vacancies in the junior ranks. Supernumerary captains of the three arms and of engineers, who desire to do so, can be placed on half-pay (*aspettativa speciale*), and receive three-fifths of their pay, until there are vacancies for them. An article in the *Esercito Militare* of the 14th July, 1909, states that this law will only be of a temporary nature, as by 1915 promotion will be normal once more, and the rank of captain attainable in 12 or 13 years.

As regards pay, it has been considerably improved since 1904, and varies from 2,000 frs. per annum for a 2nd lieutenant to 8,000 frs. per annum for a colonel.

Improvements made in the Conditions of Service of N.C.O.'s.—The following are the ranks and daily pay of N.C.O.'s:—Sergeant, 2 fr. 10; sergeant-major, 2 fr. 50; warrant officer, 3rd class, 3 frs.; warrant officer, 2nd class, 3 fr. 50; warrant officer, 1st class, 4 frs. For every additional 5 years' service up to 15 years a N.C.O. gets an increase of 30 centimes per diem.

A sergeant-major of 12 years' service has the right, on retiring, to a billet in the railways or in some administrative department of the State. A warrant officer of 30 years' service can occupy a post in the "sedentary services" up to a total of 40 years' service. Every N.C.O. is entitled to a pension after 20 years' service, and at the age of 42.

Changes Affecting the Conditions of Service of Corporals and Soldiers.—These are:—(1), The voting in 1908—1909 of 3 million francs to improve regimental schools, libraries, and recreation rooms; (2), a vote of 1 million francs to improve the soldier's food; (3), the adoption in 1909 of a grey-green uniform by the infantry, alpine troops, bersaglieri, and engineers; (4), an increase in the travelling allowances of corporals and men; (5), new disciplinary regulations; (6), a new law, making it easier for corporals who wish to continue in the army and attain the rank of N.C.O. to do so.

Reorganization of the Artillery.—The Commission had to report which field gun it considered the most suitable for adoption in the Italian Army, and selected the Krupp gun, several of which had already been ordered by the War Minister. In February, 1909, a fresh order was given to Krupp, amounting in all to 861 guns, of which 356 were to be delivered finished, and the remainder to be finished in Italy. Thus in two or three years' time Italy will possess some 1,500 guns of 75 m.m. As regards howitzers, Krupp have received an order to deliver twenty-nine 4-gun batteries of 149-m.m. howitzers.

110 Maxims (fifty-five 2-gun sections) have been instituted; more are to follow; experiments are being made with two Italian machine guns. The mountain artillery is to be re-armed with the 65-m.m. gun.

Fortifications.—200 million francs have been voted to reorganize the system of fortification on the N.E. frontier, and to re-arm those forts with

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heavier guns. The main decisions of the Commission on this subject have however been kept secret. The purchase of about 100 armoured cupolæ for these forts (6″ guns) is at present being studied.

Schools for the Training of N.C.O.'s in the Norwegian Army.—The selection and subsequent training of N.C.O.'s, even in a regular army, is by no means an easy matter, and in an army composed of Militia units the difficulty is much increased. The Norwegian military authorities seem to have found however an ideal solution to the question, for although their army is exclusively composed of men who come up for training for a few days only each year, the classes for those who aspire to become N.C.O.'s cover a period of three years. The State is saved the expense of having subsequently to provide billets for those who elect to go through these classes by the fact that, in all large business houses, old pupils are much appreciated and good berths kept open for them, owing to the excellent general and military education they receive at these schools.

For the infantry there are five "brigade schools," one per brigade. Each school is under a captain, and has 165 pupils. Candidates for admission must come from one of two sources. They must either be men of 18 who pass certain theoretical examinations and certain military exercises but have not yet been called up for service, or be soldiers who have satisfied the same conditions, and who have also been well reported on during their summer training.

The pupils are divided into three "years." At the end of each year's course they have to undergo an examination. The theoretical work takes up 33 weeks per annum, which include three days' military training per month. Twelve weeks (June to August) are devoted to manœuvres and field training, which includes two weeks' topography.

The syllabus of instruction includes the study of the Norwegian language, history, geography, elementary mathematics, natural history, chemistry and physics, handwriting, drawing, book-keeping, English (optional), singing (optional), tactics, musketry, gymnastics, military administration and organization, military law, topography, hygiene and first aid, swimming, ski-ing, and bicycling. After satisfactorily passing their final examination, the pupils are posted as corporals of the reserve to the units in which they would have served.

The same system applies to the other arms.

In the cavalry there is an "instructional squadron" of 76 men.

The field artillery has two schools—one at Christiania of 160 pupils, and one at Trondhjem of 24. The fortress artillery has a school of 166 pupils. The corporals' class lasts two years, and the sergeants' four. The mine and signal specialists undergo a machinery course.

The Engineers' School has 64 pupils, with a 4-year course.

In the Transport Corps (Train) School there are 70 pupils, chosen from men fit to serve in the cavalry or from N.C.O.'s of the infantry. The course only lasts 100 days, and the graduates afterwards are seldom called out.

The Supply Corps School has 25 pupils; a 72-day course.

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The Medical Corps School includes a school for sergeants, in which the courses last six months, and are attended by 15 pupils, and a school for corporals, attended by 130 men, for a period of 24 to 30 days.

These schools have hitherto proved a great success, providing both excellent N.C.O.'s, and, in civil life, a class of men well educated and well disciplined.

MILITARY NEWS OF VARIOUS COUNTRIES.—*Austria.*—The time officers have to remain in the same rank is:—2nd lieutenants, 6½ years; lieutenants, 10 to 11; captains, 10 to 10½ for staff officers, 13 to 13½ for others; majors, 4½ years; lieut.-colonels, 3; colonels, 6 to 6½ years; brigade commanders, 4 years.

Germany.—It was noticeable in the Imperial manœuvres of 1908 that there were practically no white horses in the cavalry. Some of the officers' horses, although of a light colour, were such as not to be easily visible in the field. White horses are now to be found only in those units, like the transport services, where their conspicuous colour is of no importance.

Australia.—Before the Commonwealth was proclaimed, Australia could only call out 21,575 men for defence, and this was far too small a force to guard so large a continent. By a new law, the armed forces of Australia in a few years' time will amount to 260,000 men, ready to take the field at a moment's notice, and 115,000 reservists. These are obtained from the following sources:—Cadets under instruction, 152,000 (37,000 of whom over 18); Militia, 29,000; Reserve Militia (20 to 26), 80,000; Reserve Volunteers (under 26), 60,000.

A. H. SCOTT.

RIVISTA DI ARTIGLIERIA E GENIO.

October, 1909.

ON THE ORGANIZATION FOR THE DEFENCE OF LARGE FORTIFIED PLACES.—By A. Gentile, Colonnello del Genio.—In fortification, as in other branches of the art of war, nothing is absolute. Vauban has said that it is an art founded on common sense and experience, and while much has been published regarding the best system of attack to adopt, in order to obtain possession of a strong place furnished with all the means of defence provided by art and industry, little or nothing is said of the defensive dispositions which are necessary to increase the difficulties of the attack.

When we come to examine what has been agreed upon as to such defensive dispositions, in view of the terrible effects produced on walls and on ordinary structures by elongated shells charged with powerful explosives, we find that there are advocates for two systems: viz. the system of armoured forts at wide intervals, which has General Brialmont for its chief supporter, and the alternative system, advocated by Von Sauer,

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of small forts with reciprocal action, arranged in more lines and near to one another.

In both these systems materials offering greater resistance to the penetration of projectiles are substituted for ordinary walls. Such structures being of cement iron and steel, have unavoidably necessitated a diminution in the number of forts in the first system, owing to the great cost of the materials, and this again necessitates an increase of forts of the second system.

When the first system is used, the defence has to provide occasional works in large numbers for reinforcing the intervals between the forts. This is unnecessary in the second system, and, indeed, induced Von Sauer to devise a method of rapid attack which has excited a good deal of attention in military circles and which is divided into four phases, viz. :— 1st.—A reconnaissance of the ground, and simultaneously an approach to the place. 2nd.—Advance of the attacking columns sustained by field artillery and occupation of the external ground. 3rd.—Posting (during the night) of bombarding batteries for curved fire. 4th.—Attack "de vive force," prepared for by the bombardment. Without entering into the merits of such a system of attack—which, it should be noted, depends essentially on the defensive conditions of the place, on its conformation, structure, armament, discipline and moral qualities of the garrison—it is evident that strong places organized in the manner suggested by Von Sauer should be completed in peace times, and would not be capable of resisting the regular systematic siege by an enemy provided with the powerful siege appliances with which armies are now provided.

Even though the system of a girdle of forts at wide intervals and at a distance of 6 or 7 k.m. from the nucleus be adopted, it is evident that when once the investment of the place is completed up to the commencement of the second period of the siege, the attack has an undoubted superiority over the defence. In fact, while the defenders are unable to conceal themselves from the view of the ground beyond the forts, the attackers can freely select places under cover from which they can commence firing from their batteries with security, observing the effects of the shots, and finally silencing the defenders. These latter, enclosed in a circle of iron, are endeavouring with inadequate means to carry on the defence, expending time and ammunition, sacrificing many men and much material, and ending in being overcome in a period more or less short according to the energy and activity displayed.

With regard to the expenditure of material Lieut.-Colonel von Schwatz of the Russian Army, who took an active part in the defence of Port Arthur when in command of the engineers at Fort Erlung, notes that of four pieces of 15 c.m. mounted in the fort, all were dismounted four hours after the commencement of the bombardment, the fort itself being reduced to silence.

The author next offers the following suggestions (*a*). To defend the position by means of lines at intervals not greater than 1,000 m., and distant from 7 to 8 k.m. from the nucleus of the place. These lines to be defended by largely employing field artillery, mitrailleuses,

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and rifle fire. It is essential that the organization should be worked out in time of peace, so as to be able to assure completeness in time of mobilization. Along the concealed lines the necessary armoured and walled works should be provided to resist sudden attacks, and should only be brought into action as occasion required. (*b*). For the reinforcement of the troops employed in these lines of defence, and for bringing up men and material to strengthen the threatened points, a covered road of circumvallation should be constructed, with other roads radiating towards the nucleus, and towards the principal magazines of the place. (*c*). In rear of these lines of resistance the principal works should be established situated near the main roads leading to place. Their function is to act concealed from the enemy's view, with prepared fire on the area of the ground occupied by the attack, and they should be at an approximate distance of 7 k.m. from the nucleus. They should be closed works, limited in development and in depth to what is required for the firing of the guns and for the protection of the ammunition. They should be armed with powerful artillery for direct fire and also for curved fire, placed *en barbette*. Shields of steel with loopholes for the mitrailleuses and rifles should be provided at the angles. Artillery is also installed on the flanks with suitable walls for protection. The command of the works is very small; the ditches have the fronts and flanks of a triangular section, with a very gentle slope of earth, and counterscarp galleries with barbed wire obstacles. The ammunition for three or four days' fire or more (from 150 to 200 rounds a piece) should be kept in magazines and should be replenished at night. Shelters for the men will be provided in the terreplein of the work. (*d*). An adequate telegraphic and telephonic service should be provided for the transmission of orders and notices between the various positions of the defence; homing pigeons and wireless telegraphy for communication with the outside world and with the manœuvring troops; plant for the observatories as well as acetelyne searchlights for the illumination of the ground in front of the lines, are also necessary, and both dirigible and ordinary balloons for reconnoitring purposes, and for observation of the results of fire.

November, 1909.

APPARATUS FOR VISUAL SIGNALLING.—*Communication between two Stations separated by an Obstacle.*—In order that two stations may be able to communicate with one another by means of visual signalling, it is not indispensable that they should be able to see each other, since, when separated by an obstacle which prevents their pointing their apparatus one towards the other, they may exchange signals by indirect methods. One of these methods is to employ powerful electric searchlights with convex mirrors such as are used for signalling to a distance at sea.

The principle is as follows:—When at the transmitting station the searchlight has its axis directed towards the clouds in the direction of the receiving station, also provided with a searchlight, the occultations of the light situated at the focus of the lens of the apparatus, produce on the clouds, which act as a kind of opaque screen, a series of alter-

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nating flashes. By this means, applying a conventional alphabet such as the Morse, communication can be established to a great distance. The use of these searchlights—the principle of which however is inconvenient as it depends upon the state of the atmosphere, requiring a cloudy sky—permits two observers whose direct view is impeded by inequality of the ground to communicate freely with one another up to a distance of 60 or 80 k.m.

Another indirect method of visual communication which is very useful on service to troops in the field, consists in the use of luminous balloons, both free and attached. The aeronauts are able to ascend to considerable heights and can transmit signals to each other.

It is generally forbidden to supply the aeronauts of the attached balloons with the electric generator required for the production of a powerful light, and communication with the ground is maintained by metallic wires for the transmission of energy; while as regards the free balloons the car is provided with a sufficient electric battery. The luminous signals are made with a Morse manipulating key. The engineer Yon proposes to suspend the luminous apparatus below the balloon, and to signal the transmission of messages in the same way as by visual telegraphy, by means of flashes and occultations of the light, using the Morse code.

Others however have proposed a system similar to that in use by warships for signalling at night. This system consists of attaching below the car a series of small balloonets in each of which is placed an incandescent lamp; each of these lamps is lighted by means of a special commutator which allows the composing of a particular alphabet, that is a series of signals visible at a great distance. The advantage of these balloonets consists in the fact, that when special precautions are taken they are not visible from all points of the horizon, and they admit of the sending of messages without being intercepted or impeded by the enemy.

The method of telegraphic communication by means of balloons is not new. In 1875 Léard communicated by this means from Algiers with the National forts distant 100 kilometres and separated by a high mountain.

Studies and experiments were made in 1883 by the French aeronaut Gabriel Mangin, and in 1884 by Buchholz in Austria and Bruce in England; and on the 13th April, 1886, a series of very interesting experiments were made by Schoenberg in the vicinity of Berlin, by the ascent of a balloon to a height of 60 m. carrying in the car an electric lamp in communication with a Siemens dynamo; the rays being projected in all directions and the ground becoming visible in detail at a considerable distance.

Mangin adopted in 1884 the following system:—An electric incandescent lamp, Swan type of two candles requiring 40 volts and 1 ampère, was placed in the centre of an attached balloon; the lamp communicated by means of two conducting wires with the electrical generator in the office where the operator worked. A Morse manipulator allowed the operator to reproduce at will, short and long occultations of the light

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emitted from the interior of the balloon, which assumed the appearance of a luminous globe by the simple illumination of the incandescent lamp placed in its centre. The experiments proved very satisfactory and it is hoped that this system may prove of use to troops on service.

NOTICES.—AUSTRIA-HUNGARY.—*Courses of Telegraphy for the Infantry.*—The allotment of a certain quantity of telephonic material to the regiments of the Austro-Hungarian infantry has brought about the institution of a course of telegraphy for this arm. According to *l'Oester reich-Ungarische Heereszeitung* this course, which will take place at Tulln, will be attended in the year 1909–10 by one or two subalterns and two or three non-commissioned officers from each army corps in addition to one non-commissioned officer from each infantry regiment and rifle battalion. The instruction will commence on the 1st November and will end on the 31st July just before the manœuvres.

The Network of Wireless Telegraphy Stations.—From the *Militär-Zeitung* we learn that the network of wireless telegraphy stations is being continually developed. The principal stations are those at Vienna, Trieste, and Pola (this last is for marine purposes). Other stations are being constructed at Cattaro, Sebenico, Sarajewo and Lemberg to which will afterwards be added others at Budapest and Hermannstadt. In addition to this, after the completion of the network, the more central stations may be put into communication with the base of operations of the fleet, and possibly with the frontiers of Bosnia, Herzegovina, Italy and Russia.

EDWARD T. THACKERAY.

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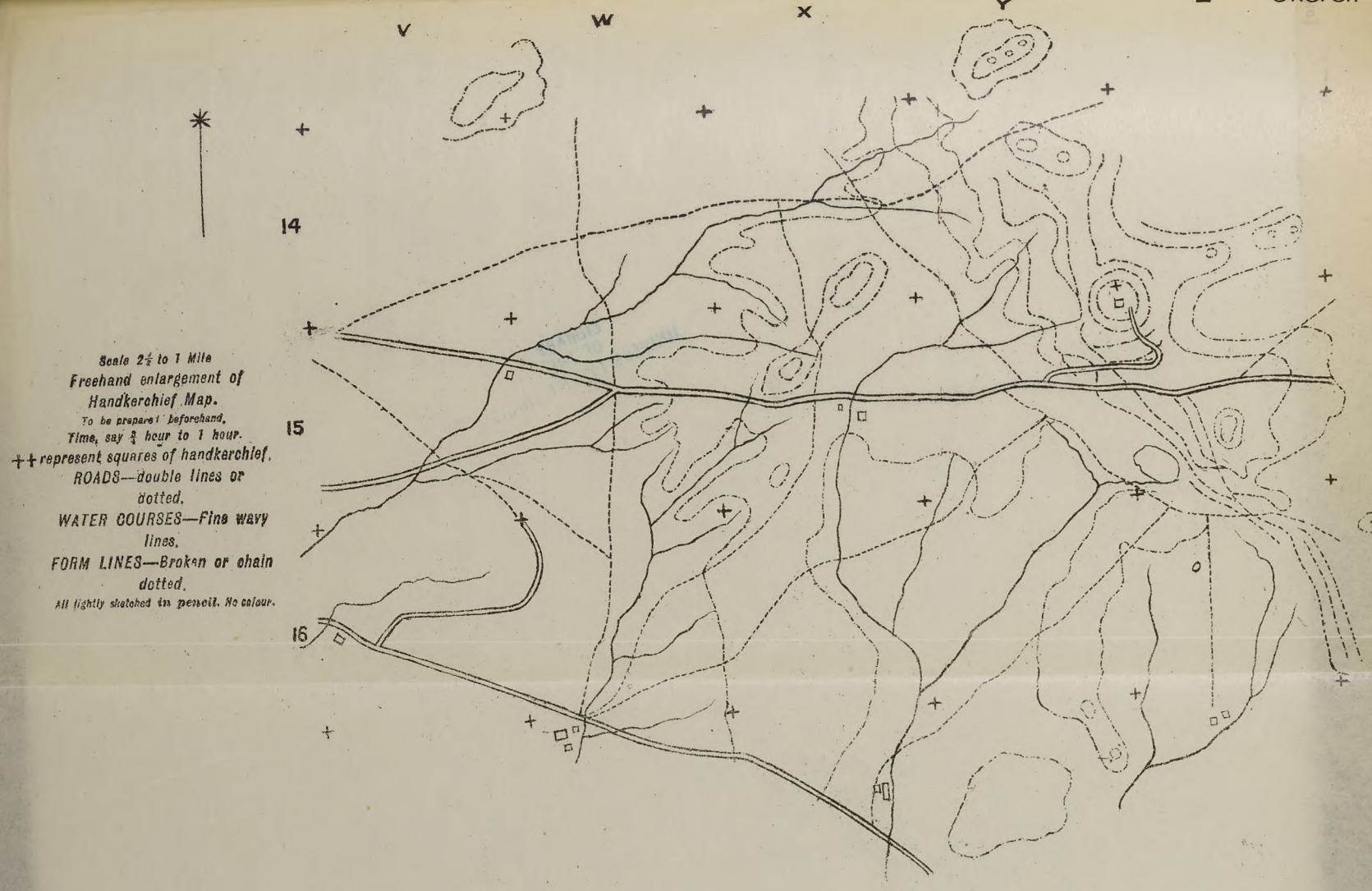
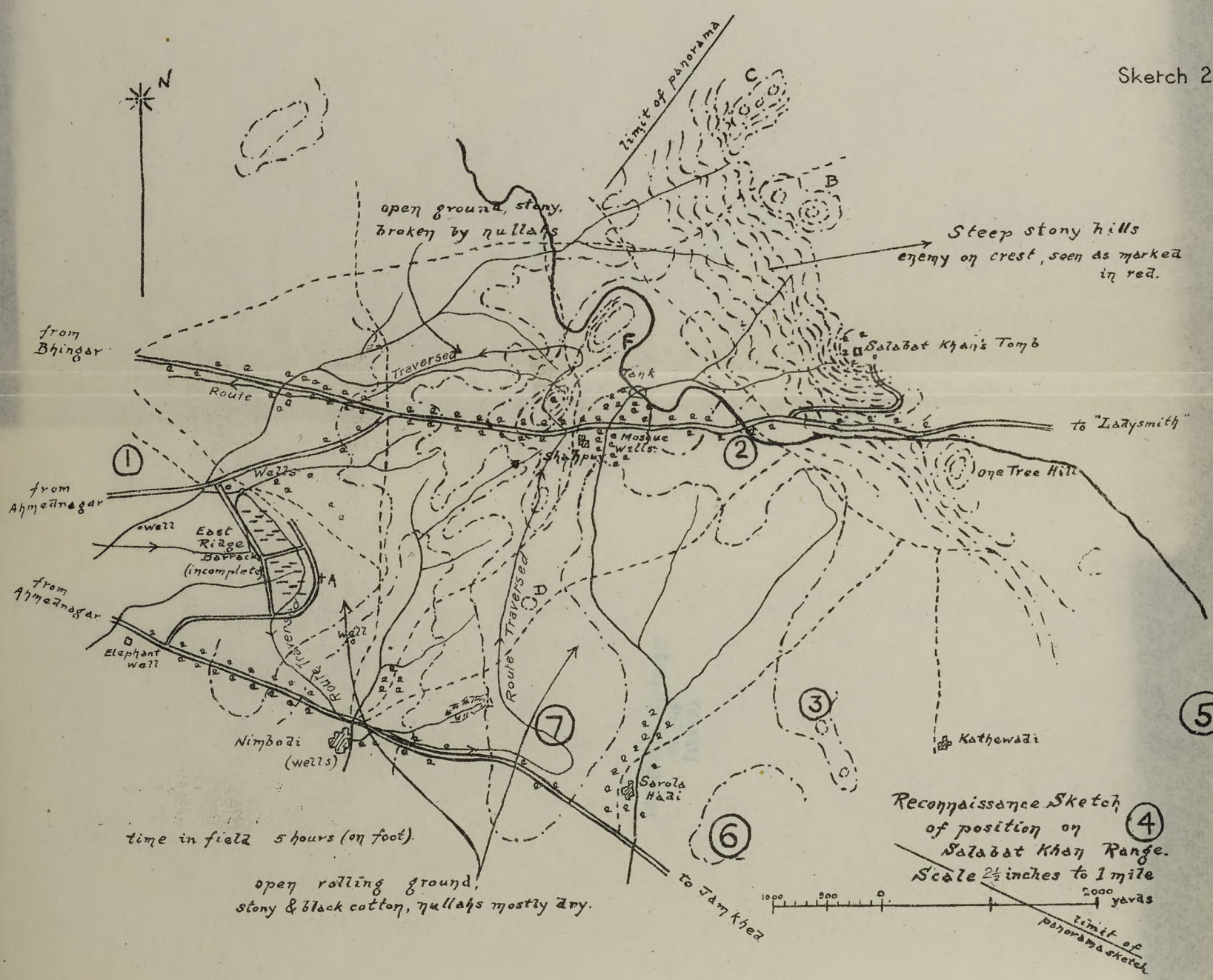
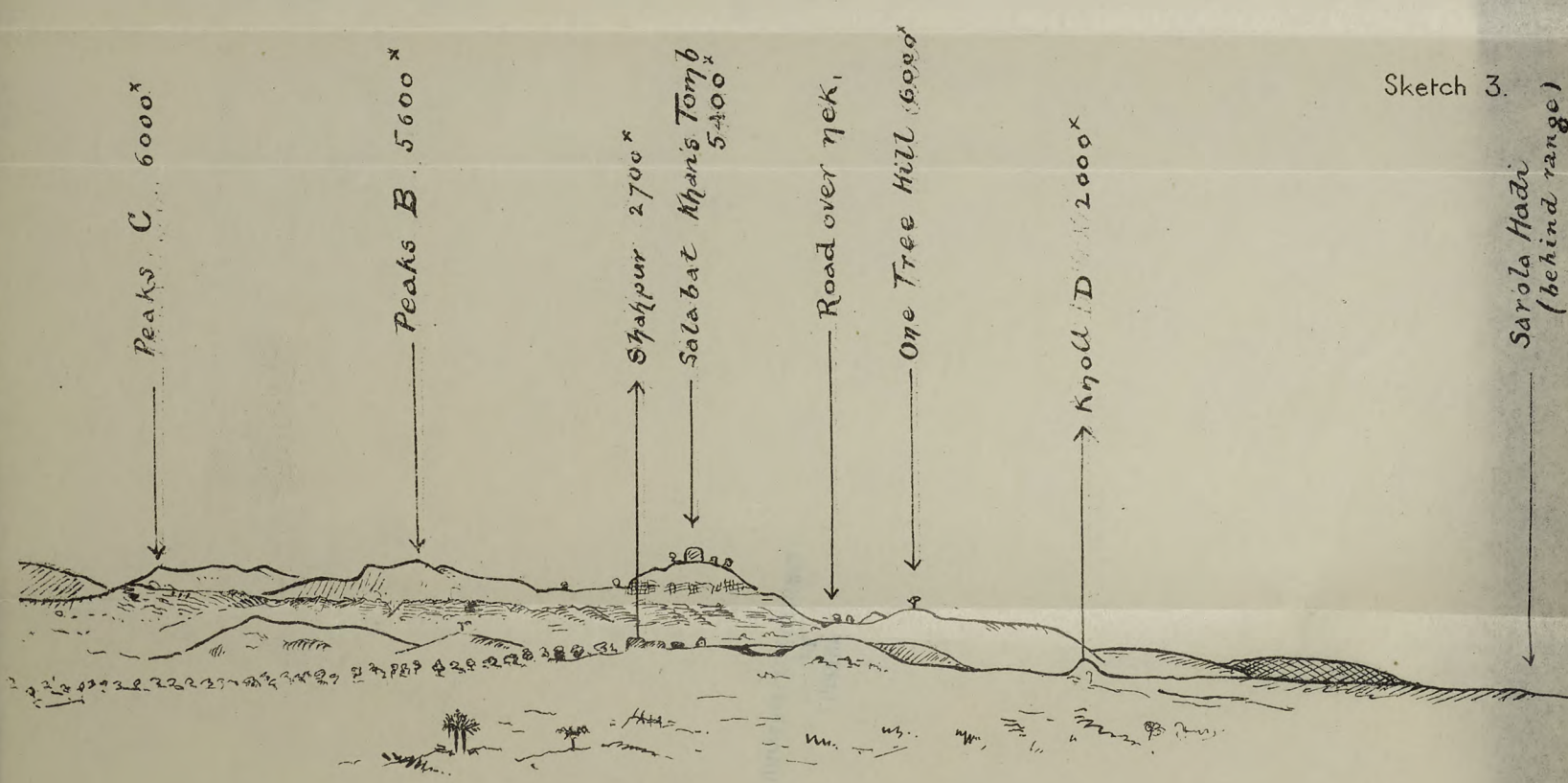
Sketch 1



Sketch 2.



Sketch 3.



Panorama Sketch from "A" on East Ridge (looking eastwards)

RECONNAISSANCE AND SKETCHING.

The Scale in the originals of Sketches 1 and 2 was 2 inches to 1 mile.

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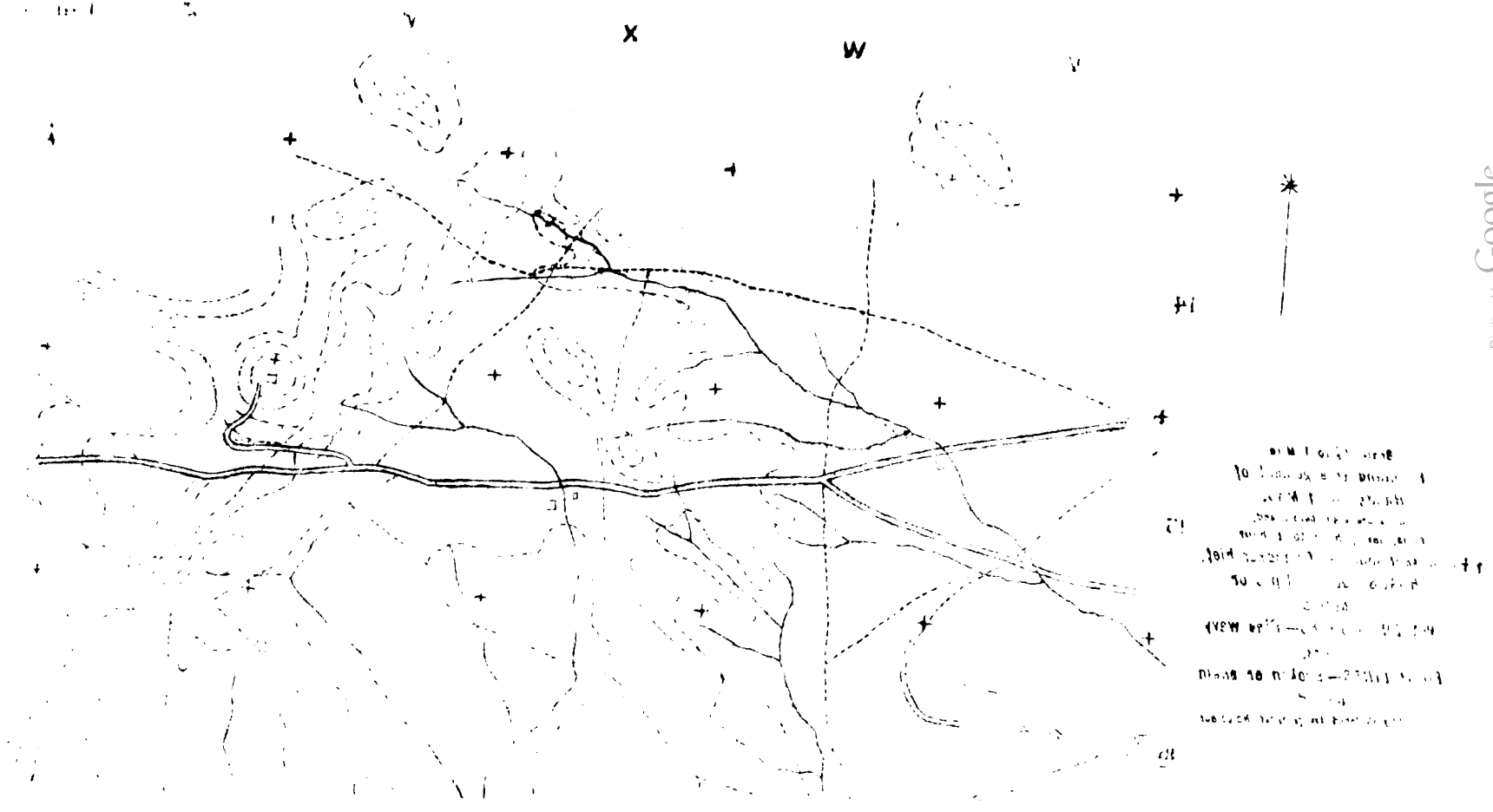

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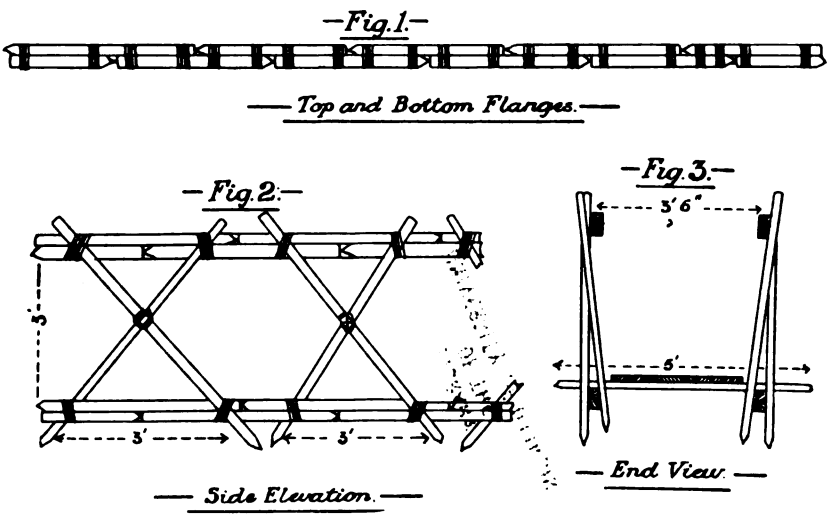
SOME IDEAS ON FIELDWORKS.

THE following extracts from the reports on the Annual Fieldwork Courses for the year 1908—1909 are published as being of general interest.

1. LATTICE GIRDER BRIDGE OF 5′ PICKETS (*Figs.* 1, 2 and 3).



The girders were 18′ long, and, after taking a certain sag were quite strong enough for a footbridge. The lashings were of spun-yarn. The time required for making one girder was 6 man-hours.

2. MASKING LOOPHOLES.

Amongst various attempts at concealing slit loopholes, the experiment was tried of placing a rough trellis work of brushwood at a gentle slope against the front of the parapet. The sticks were not so close as to impede the view or the fire from the parapet. Sods were laid on at intervals and, from a distance of 500 yards, the loopholes were very successfully concealed.

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3. DRINKING WATER SUPPLY (*Figs.* 4, 5 and 6).

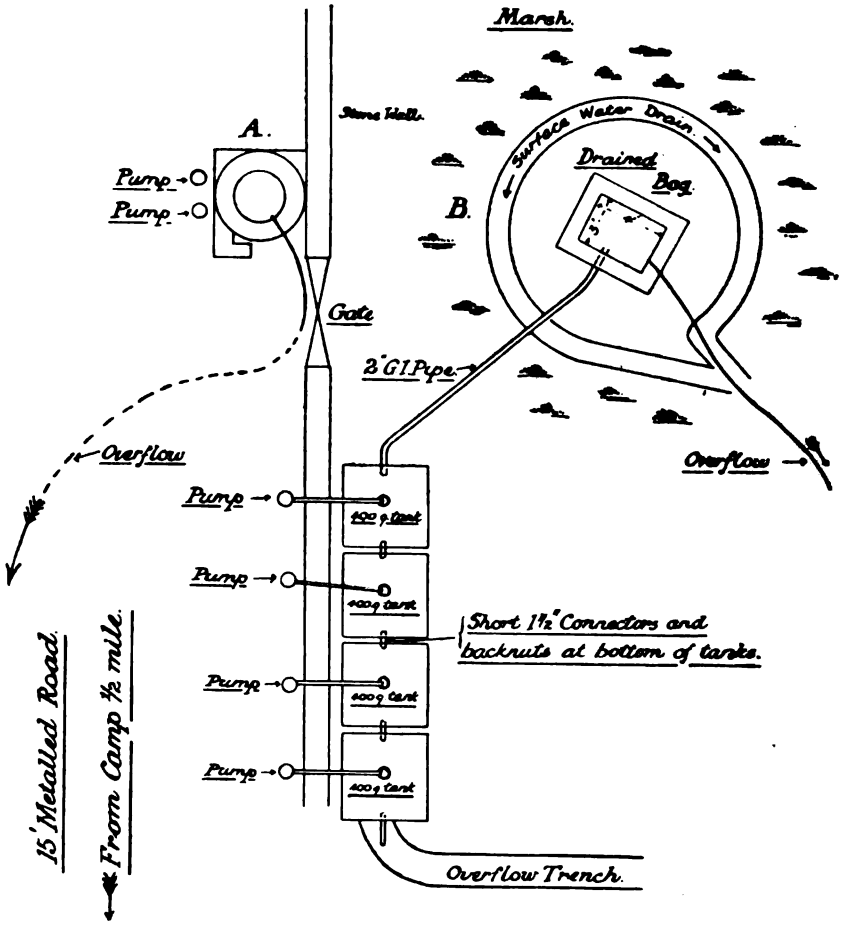
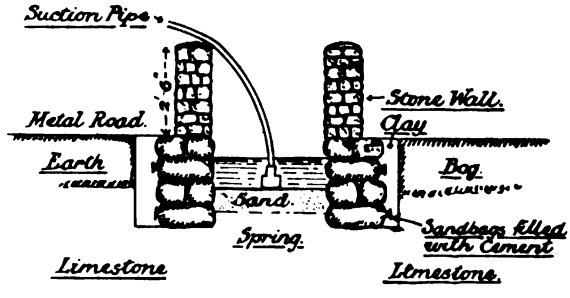


Fig. 4.
Scale—11′ = 1 *inch.*



—*Section at A.*—

Fig 5.
Scale—5′ = 1 *inch.*

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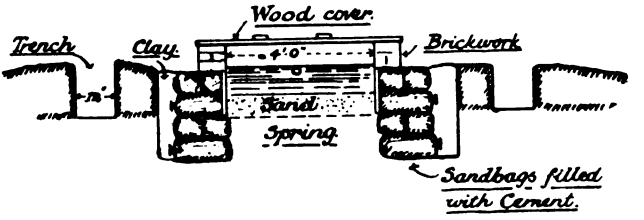

— Section at B. —

Fig. 6.
Scale—5′ = 1 *inch.*

During the 6th Divisional Manœuvres the drinking water for a standing camp at Aglish was obtained from two springs on the top of a hill ½ mile from camp. The water was analyzed and was pronounced pure. The springs were dug out and protected from pollution by a lining of cement (in sandbags) and clay, carried down to the limestone stratum 1′ below the surface of the soil. The water from one spring was piped into four 400-gallon tanks connected at the bottoms, inlet and overflow being at the top. The other spring had a supply sufficient to keep two pumps going direct.

4. PLANK GIRDER AND PLANK TRESTLE (*Figs.* 7, 8 and 9).

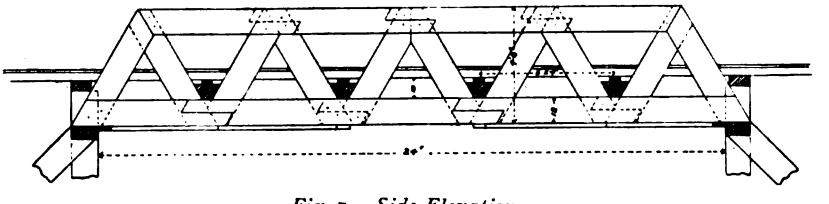

Fig. 7.—*Side Elevation.*

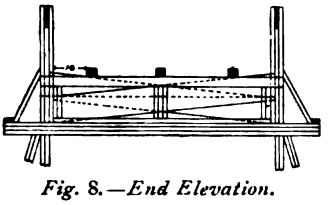

Fig. 8.—*End Elevation.*

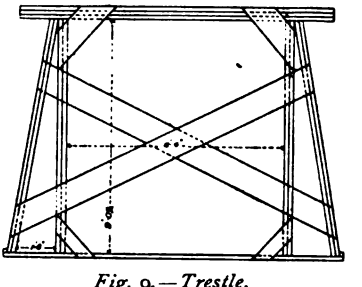

Fig. 9.—*Trestle.*

Trestles and Girder—13′ × 12″ × 2″ *planks.*
Transoms—9′ 6″ × 10″ × 5″ *sleepers.*
Baulks—5″ × 4″ *gunnels and* 4″ × 4″ *barrel-pier baulks.*
Fastenings—½″ *coach-screws and* 5″ *wire nails.*
Scale—7½′ = 1 *inch.*

This bridge was constructed to carry infantry in fours. It is sufficiently explained by the figures.

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5. FIELD REFUSE DESTRUCTOR AND BOILER (*Figs.* 10 and 11).

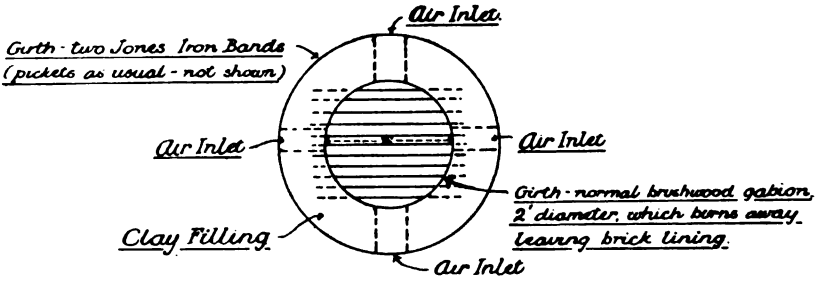

Fig. 10.—*Plan.*

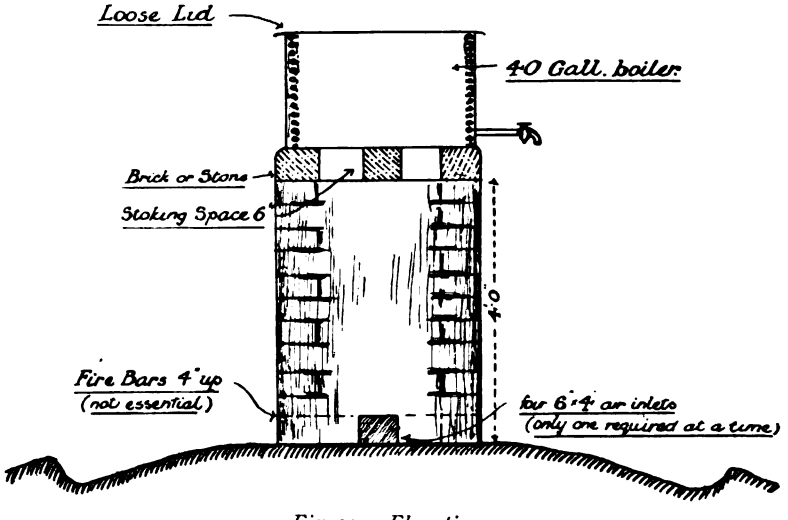

Fig. 11.—*Elevation.*

This was a successful type of destructor. The boiler was used to boil the drinking water for the company during the course.

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6. Cantilever Bridge (*Fig.* 12).

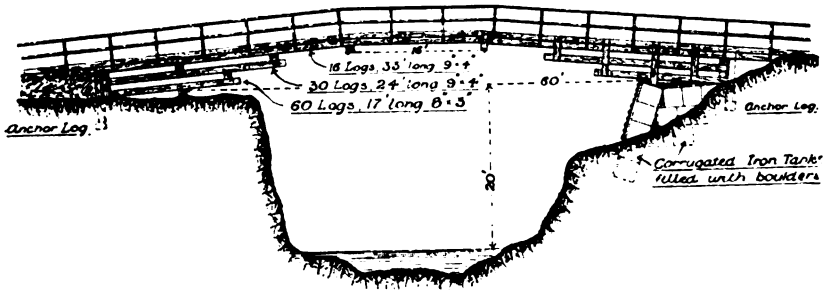

Fig. 12.

Scale—23′ = 1 *inch.*

The company was enabled to make use of a large quantity of timber which had been condemned as unserviceable for ordinary purposes. The bridge was erected for permanent use over a span of 60′, and was calculated to carry infantry in fours. The time taken was 2,110 man-hours.

7. Notes on Night Attacks.

On the Attack.—When a flare goes off, the attackers must lie down and keep quite still, any movement is likely to be observed.

To prevent noise when wire is being cut, a man should hold the wire on either side of the cutter.

On the Defence.—No projecting poles, planks, etc., should be left in the trench. Steps should be provided freely, to prevent men falling down steep drops. Sound cannot be heard through a loophole so well as over the top of the parapet, if the wind is blowing through the loophole. Before a flare is ignited, the defenders should be warned as to which flare is going off. After a flare has been fired by electrical means the leads should be knotted or otherwise marked in order to prevent attempts at using them again.

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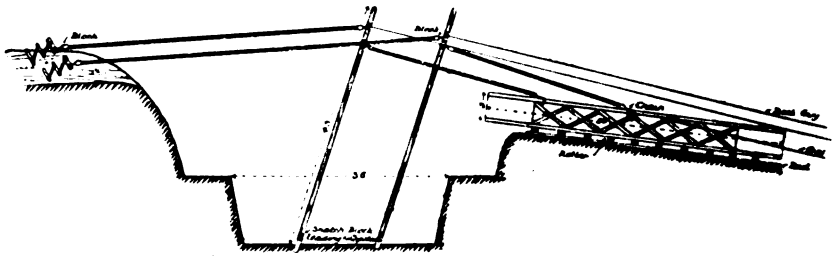
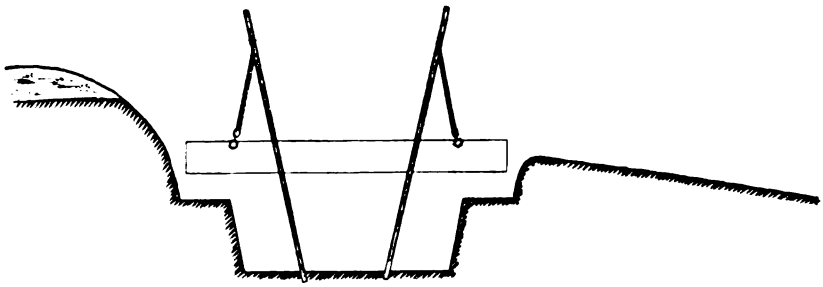
8. PLACING 7-TON GIRDER IN POSITION (*Figs.* 13 and 14).



—*First Position of Derricks*—

Fig. 13.



—*Second Position of derricks and attachment to girder*—

Fig. 14.

Scale—32′ = 1 *inch.*

Two 40′ derricks were used, with guys of 2″ steel wire rope. The sketch shows the general arrangement. The attachment to the girder of the tackle of No. II. derrick was shifted to the rear end of the girder, when the latter was nearly at its balancing point on the rollers.

J.C.M.

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THE EARLY ROMAN MILITARY CONSTITUTION AND OUR OWN.

By COLONEL S. A. E. HICKSON, D.S.O., LATE R.E.

THE interesting account of the Comitia Centuriata of early Rome, given by Colonel Ruck in the *R.E. Journal* for January, shows again very clearly how closely the early English military system, as constituted under the Assize of Arms of Henry II., resembled in some respects that of early Rome. In the case of Rome however the valuation of their fortunes was sworn to by the people themselves. In the case of England the wealth of the citizens was testified to, before justices of the peace, by legally appointed jurors, as representing the people; a measure which is looked upon as a first step, leading in the direction of our existing representative or parliamentary form of government.

A matter of further interest is the fact that both the Roman and the Saxon systems were originally tribal in form, the bonds of union being love of freedom and study of the use of arms; but whereas in all the early Germanic tribes, to which the Angles, the Jutes, and the Saxons belonged, military service was a personal duty owed to the State irrespective of land, in Rome the franchise and military service appear from the first to have been connected with the holding of land. In England it was not till after the invasion of the Danes that, by the custom of "commendation," the rendering of military service became specifically associated with land tenure. Then it was that, as a measure of security and necessary organization for mutual defence, Alfred the Great instituted amongst his Thegns what has been called a "Nobility of Service," and the poorer freemen, or ceorls, "commended" themselves to the service of the mightier Thegns in like manner as the Thegns commended themselves to the King; that is, the ceorl sought the defence and aid of the Thegn, "and as the price of this aid surrendered his freehold to receive it back as a fief laden with conditions of military service."*

Such was the Anglo-Saxon system 200 years before the Norman Conquest and the arrival in England of feudalism. With commendation crept in the oath of allegiance, which William the Conqueror

* Green, *Conquest of England*, p. 210.

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was careful to preserve, as by it every man was primarily the King's man and owed him service before all. Thus it came about that the Anglo-Saxon military system, in the form of an English Landwehr (home defence force)—or defensive militia—in England survived feudalism, its creed being "National Service," as exemplified by the motto of the Prince of Wales, "I serve" (*Ich dien*). Throughout history "National Service" in the cause of common defence will thus be found to be the national creed, resulting from national disaster and invasion, as certainly as individual liberty becomes the cry after prolonged periods of peace and immunity from attack.

Perhaps the following account of the evolution of the constitution of Servius Tullius, or Comitia Centuriata, from the still earlier system of Comitia Curiata instituted by Romulus and referred to by Colonel Ruck, may interest your readers. It is taken from notes made by the writer 15 years ago, when reading Niebuhr and Mommsen, and perhaps the classical researches of Colonel Ruck may be able to throw further light on the matter, and correct or elucidate any imperfections. It shows how in Rome the original tribal system tended, as did the continental feudal system, towards local hostility and inter-tribal dissension, and how, in consequence, measures were taken under Servius Tullius to mix up all the various tribes together in the new centuries and legions.

Before the time of Servius Tullius the country about Rome was not united with the State. No patrician could acquire landed property in the country districts any more than a plebeian could at Rome; and, as Colonel Ruck points out, "only those Roman citizens who lived within the city, or were included in some Curio or Urban parish, had the right to vote." "But there now appeared," says Niebuhr, "a legislator who gave to the commonalty a contribution which was complete in itself, and devised forms by which this commonalty became united with the whole body of burghers. Servius Tullius divided the city of Rome, so far as it was inhabited by pale burghers (plebeians), into 4, and the territory around it into 26 regions."* The four *Roman* tribes were Palatina, Collina, Suburana, and Esquilina. But the divisions *now* made were purely geographical, and in no way connected with certain *families*. "Everyone received a name from the region in which he lived; but when he changed his abode he did not thereby cease to belong to the local tribe corresponding to the region in which he and his descendants were registered." This system was modified by time, but originally "the tribes contained only plebeians, the patricians being comprised in the curies, which also

* See Epitome of Niebuhr's *History of Rome*, by T. Twiss, pp. 102 to 114, etc.

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included their clients." "There were 30 Curies of the Patricians, 30 Tribes of Plebeians, and 30 Towns of the Latins. The country tribes had names from heroes and common *sacra* with the tribes of the burghers." In the earliest times all possessed equal privileges, but later the city tribes became inferior to the country tribes. When a person became a Roman citizen without the suffrage he was not received into any tribe, nor could he be invested with any office or vote in the assembly. The qualification for voting in a plebeian tribe consisted in being a landed proprietor and agriculturalist; whoever supported himself by any other occupation was excluded.

The two corporations (Patrician and Plebeian) thus constituted, that is in their tribal form, regarded each other with hostile feelings. It was for the purpose of dispelling this feeling and effecting an accommodation that Servius created the Centuries, excluding all who had no landed property, and could therefore give no guarantee to the State. The Centuries thus included all the First Estate, all of the Second Estate who had the right of voting, and all of the Third Estate who had property equal to the Second, and, lastly, persons engaged in certain honourable occupations. Servius exempted the burghers from serving on foot. "He composed the cavalry of the three ancient double tribes or 6 Centuries of Tarquinius Priscus, and to them he added 12 other Centuries of the plebes." These 6 Centuries comprised the entire Patrician order. In the Plebeian order Servius Tullius separated the more noble and wealthy into two classes—"the Latin nobility, and those who did not belong to it." To the nobles (as Colonel Ruck points out) he assigned the 12 remaining equestrian Centuries, and this without any regard to property. All those not contained in the equestrian Centuries were again divided into such as possessed more than 12,500 asses and less. The former of these were subdivided into five classes, according to the value of their property.

The 1st Class comprised those of	100,000	asses, and had	80	Centuries.
,, 2nd ,, ,,	75,000	,, ,,	20	,,
,, 3rd ,, ,,	50,000	,, ,,	20	,,
,, 4th ,, ,,	25,000	,, ,,	20	,,
,, 5th ,, ,,	12,500	,, ,,	30	,,
	Total foot	...	170	,,

The above details coincide with Colonel Ruck's account. The 1st Class contained all plebeians of property and the "Gerarians," *i.e.*, those who were not contained in the tribes, but whose property

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placed them on an equality with them, and who, if they had acquired landed property, were enrolled in a tribe. "All persons from the age of 16 to 45 were counted as juniors; those from 45 to 60 as seniors." The seniors had no other duty than to defend the walls of the city, as, for example, in times when Rome was threatened by Hannibal, after the disastrous defeat of Cunæ.

Those whose property was less than 12,500 asses were again subdivided into two sections:—

Locupletes	...	...	...	having over 1,500 asses.
Proletarii	...	...	...	having under 1,500 asses.

The latter were exempt from taxes. Each of the above had 2 Centuries, and besides these there were *three* Centuries of the trades as engineers, etc. Colonel Ruck says "2 Centuries of Artificers," and adds that these were included by Livy in the First Class, or Classici. No doubt changes occurred at different times, but Niebuhr has the following remark:—"These *three* Centuries did not consist of plebeians, for no plebeian was allowed to engage in other occupations than agriculture; but there existed at Rome certain guilds, and their number was three times three, *i.e.*, pipers, goldsmiths, carpenters, dyers, saddlers, tanners, coppersmiths, potters, and the ninth included all other artificers." They were usually freed men and foreigners. Perhaps this note will help to elucidate Colonel Ruck's remark and doubts as to the position of these Centuries of Artificers. Niebuhr wrote a pamphlet, "Von den Comitien der Centurien im zweiten buch *Cicero's de republicâ*," which gives the clue to his sources of information. Lastly, Servius also took notice of those free people who did not belong to the commonalty. Many of them undoubtedly entered the service either by compulsion or of their own accord, for, says Niebuhr, "I cannot believe that the 'capite censi' and the proletarii did not perform any service at all; they did not fight against the enemy, but served only in the baggage train as lixæ and calones (sutlers and servants), as there is no reason for supposing that these were always slaves."

Thus the system of the old Legion harmonizes precisely with the several orders of classes. The 5th Class were the skirmishers (Livy I., 43, fundas lapidesque misiles gerebant). In the 4th Class we recognize the light infantry (hastas et gaesa ferentes, Livy VIII., 8), who only carried the "hastam et verulum" without shield. These "Hastati" formed the front rank of the legion.* The front rank of the "Principés," or main body of the legion, was formed of the

* It might be more correct to say that the hastati formed a line in front of the main body of the legion.

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juniors of the 1st Class (insignibus maxime armis). The Triarii (veterans) formed the third rank, or reserve. "Only such as belonged to a plebeian tribe came under the regular annual conscriptions; others were merely called out in extraordinary cases, and when civic legions were formed. If anyone was turned out of a tribe, he merely lost the right of serving in the legion. Levies were made according to the tribes, of which there were 30 (see Dionysius IV., 14), "for which reason, moreover, the Century of the original legion consisted of 30 men, and was reckoned by the annals at 20 for the time when the tribes were reduced to that number."* This principle of raising troops by the tribes lasted as long as there was any distinction between the plebeians and Gerarians (the lowest class). "It appears to me probable that the Centuries were so constructed as to include all who in any manner bore the name of Roman, although the exclusive obligation of the plebeians to serve leads us to suspect that originally they alone formed the classes. But the clients of the patricians must have been admitted into them very early, for by their means their patrons exercised great influence in the education."

I have ventured to give the above account in continuation of Colonel Ruck's valuable quotations, in order to illustrate and show how closely civil and military rights were associated in the early constitution of Rome, as they were also in England; also to show how much the question of landed property and agriculture entered into political organization and rights.

Readers of Mahan's *Nelson* will remember that Niebuhr was one of the defenders of Copenhagen against Nelson in 1801. The Prussians were at that time studying history, and more especially military history, with avidity. A little later, after the Battle of Jena, where Napoleon so effectually crushed them, they found it necessary to entirely reform their whole system. The first steps, immediately after the peace of Tilsit, was an edict revising their entire land system, with the view of increasing the number of small freeholders and freeing the cultivators of the soil from the landowners.

The avowed object was to stimulate patriotism and give independent interest in the welfare and freedom of the country to as large a number of people as possible. The introduction of universal military service at a National Congress at Kœnigsberg followed, when it was resolved to arm the whole mass of the people and send them to fight the French and free their country.

It is noteworthy that at the present time it is the avowed policy of both parties of our State to increase the number of small landowners and cultivators in this country, and nothing could promote national

* Perhaps Colonel Ruck can explain this passage of Niebuhr.

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security and defence better than the improvement of agriculture, as it is notorious that there is no more patriotic or better soldier than the land cultivator or yeoman. In Rome, as Mommsen tells us, "The new organization of the army was accompanied by a more careful supervision of landed property on the part of the State. It was now either enacted for the first time, or, if not, at any rate ordained more precisely, that a land register should be established, in which the several proprietors of land should have their fields, with all their appurtenances, servitudes, slaves, beasts of draught and of burden, duly recorded, . . . and a revision of the register of landed property, which was at the same time the levy roll, was directed to be made every fourth year. The emancipation and the census thus arose out of the Servian military organization."

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REINFORCED LIME CONCRETE IN INDIA.

By Lieut. C. F. Stoehr, R.E.

The present standard type of roofing for Military Works buildings in the Indian plains, viz., tiling of the Allahabad or a similar pattern, supported on sal rafters and battens, has had no serious rival in the Military Works Services for many years.

In the Public Works Department a roof composed of jack arches and kankar lime concrete, supported on rolled steel beams, has been largely used, but this system has some defects. Cracks are apt to appear, causing leaks, and it sometimes happens that echoes cause much annoyance. The internal appearance also is not very good.

In Europe and America reinforced concrete is being ever more widely used, but over the greater part of India the high price of cement—due to the great cost of carriage over long distances—renders the application of this system impracticable; for example, a barrel of cement, which costs Rs.8 8- at Bombay, costs about Rs.14 8/- at Jhansi. A substitute for cement however, which fulfils the essential condition of cheapness, is to be found in kankar lime. So far as I can ascertain, the matter was first taken up by the P.W.D. in 1905, and in that year experiments were carried out at several stations in the United Provinces. The reinforcement consisted either of iron bars or of fencing wire, plain or barbed. In many cases the reinforcement was not laid so as to give the best result, while it was obvious that in some cases the test load must have arched during application, and thus given a quite false result. One broad fact however stood out clearly from these experiments, viz., that a slab of lime concrete, 6″ thick, reinforced with 7-ply No. 4 fencing wire at 1′ intervals, could safely stand any ordinary roof load over a span of 5′.

The first attempt by the M.W.S. at Jhansi was made during the cold weather, 1907–8, when Mr. Griffith, the sub-divisional officer, asked permission to try reinforced lime concrete over a portion of the verandah of a building which was undergoing reconstruction. Rolled steel beams, 5″ × 3″, buried in the concrete slab, were used as the supports, while the reinforcement consisted of barbed wire taken from the top flange of one beam to the bottom flange of the next one—four wires per foot-run being used. As in all work of this nature hitherto carried out in Jhansi, the depth of the slab was 6″, and the distance between supports 5′. The method of placing the reinforcement is obviously unscientific, for at the centre of the slab, where the bending moment is greatest, the effective depth of the

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slab is halved. The experiment was, nevertheless, perfectly successful. During the next rains the roof was carefully watched, and beyond a slight dampness at one corner, due, probably, to imperfect connection between the slab and the wall, there was no trace of leaking.

In consequence of this successful result, some barrack verandahs, an office, and a godown, 30′ × 20′, were all roofed with a reinforced lime concrete slab during the cold weather, 1908–9. The system used for the beams of the last-named building, and the reinforcement of all of them, is shown in the drawings (*Figs.* 1, 2, 3). It may be

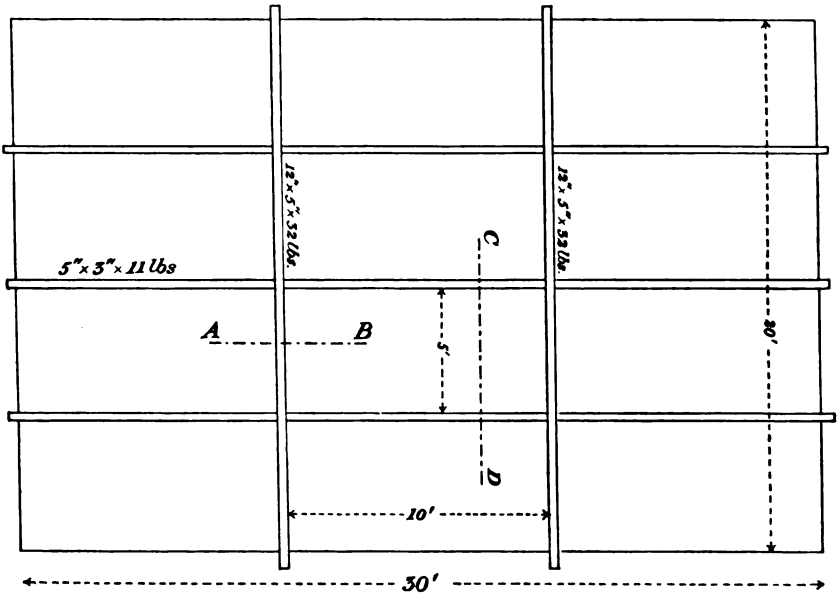

FIG. 1.

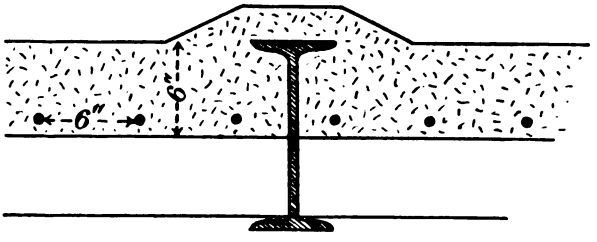

FIG. 2.—*Section and Elevation on AB.*

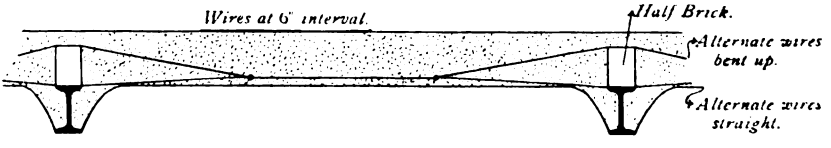

FIG. 3.—*Section on CD.*

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noted that, with concrete 6″ deep and of 5′ span, the arrangement of main and secondary beams shown in the drawing is more economical for spans of 20′ and upwards, than a single row of beams would be.

The results have, on the whole, been very successful. Slight cracks have appeared in the godown along the line of the main beams, due to the thinness of the concrete covering these beams, and in the office verandah, for a similar reason, over the channel iron to which one end of the wire was attached (see below), while in the barrack verandah, cracks have appeared owing to the lack of expansion joints. These defects are easily avoidable, and this type of roof is now used at Jhansi whenever practicable.

While these works were in progress a series of experiments was carried out (*vide* Appendix I.), in order to find out the best amount and distribution of the reinforcement, and to obtain a guide for future progress.

The following figures show the comparative cost of tiling and reinforced concrete. The tiled roofs are typical examples of recent work; though only the estimated cost is shown, it may be accepted as accurate, for there is no item, such as centering, the cost of which it is difficult to foresee. The figures for the concrete show the actual expenditure incurred, including that on centering.

All the following rates, when given as percentage rates, are rates per 100 square feet of area roofed over.

Nature of Roof.	Internal Span of Building or External Width of Verandah.	Rate p.c.	Remarks.
	Feet.	Rs.	
Double Allahabad tiling ...	18	93	With cloth ceiling.
,, ,, ,, ...	20	107	
Single ,, ,, ...	18	77	
,, ,, ,, ...	12	74	
,, ,, ,, ...	10	55	Verandah.
,, ,, ,, ...	10	59	
Reinforced lime concrete ...	20	60	Godown.
,, ,, ,, ...	10	62	Verandah.
,, ,, ,, ...	14	54	Office and Verandah.
,, ,, ,, ...	10	65*	

* There has been no opportunity of checking this rate, which seems unduly high.

No figures showing the actual cost of a jack arched roof are available, and figures taken from estimates cannot be accepted as accurate, but the following comparison of items shows that there must be a considerable balance in favour of the reinforced slab roof.

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Rolled Steel Beams.—The cost of these is considerably less in the slab roof than in the jack arched one, and this for two reasons :—(1). Because the weight of the roof is less. (2). Because the span of a jack arch is limited to about 4′ ; if larger, the arch becomes too flat, or the rise inconveniently great. The span of the slab however is limited only by its strength, and a 6′ span appears perfectly safe ; we can thus economize by using fewer and larger beams.

For instance, a certain jack arched roof at Jhansi (that of the Brigade Office) required rolled steel beams to the amount of 22,792 lbs. in the main roof and 10,406 lbs. in the verandah, costing—at Rs.8 per cwt.—Rs.1,630, or Rs.44 per cent., and Rs.743, or Rs.18 per cent. respectively. Had a reinforced slab roof (of 5′ span) been used the amount required would have been 12,767 lbs., costing Rs.24 per cent., and 7,623 lbs., costing Rs.13 per cent. respectively.

Centering, including Dismantling.—The cost will be about the same in either case, unless it is found possible to use the lower flange of the beams, as in *Fig.* 4, when the slab roof will have the advantage, for this method is impossible with jack arches, which rest on the lower flanges.

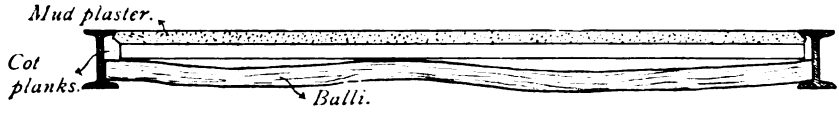

FIG. 4.

Brickwork.—Cost with jack arches, Rs.9 per cent.

Wiring.—Cost in reinforced slab, Rs.4 to Rs.5 per cent.

Concrete.—In concrete slab roof the cost is about Rs.10 per cent. In the jack arched roof about two-thirds the quantity of concrete is used, at a cost of, say, Rs.7.

Plastering Ceiling, Polishing Roof Surface, and Miscellaneous.*—The cost will be about the same. The slab roof may require Rs.1 per cent. more for oil and paper.

These results may be summed up in a table :—

	In favour of	
	Reinforced Concrete.	Jack Arch.
Rolled steel beams	Main Rs.20. Ver. Rs.5.	—
Brickwork	Rs.9	—
Wiring	—	Rs.5
Concrete	—	Rs.3
Miscellaneous	—	Rs.1

* Now abolished with reinforced slab roof, *vide* note at end.

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In comparing the cost of tiling with that of reinforced concrete or jack arches for verandahs, it must be remembered that, while the first requires only stone posts to support it, the two last need pillars and arches. The cost of posts may be put at Rs.3 per cent., and that of pillars and arches at Rs.8 per cent., with an extra Rs.6 if a chajjha is added. On the other hand, it is probable that, as experience is gained, the cost of reinforced lime concrete will be reduced, perhaps considerably.* The directions in which this reduction may be sought for are indicated further on.

The following are the results of the experience gained about certain practical points.

The centering is an item that needs very careful watching, or its cost will grow to alarming proportions. For most works the best centering consists of old cot planks, doors, condemned table and bench tops, etc. The last named will of course be wanted for repairs to barrack furniture, but they will not be harmed if first used for centering. Condemned cot planks are particularly useful, and should always be kept. Earth, finished off smooth with mud plaster, is laid on the cot planks, and just before the concrete is put down sheets of paper are spread over the mud plaster—which becomes perfectly hard after a day's exposure to the sun—and it is moistened with kerosene oil. This paper is necessary in order to give a smooth under surface to the concrete; on the removal of the centering it is easily peeled off.

The whole rests on scaffolding, or better, on ballies supported by the lower flanges of the rolled steel beams, as shown in *Fig.* 6. In the case of several buildings, or of one very large one, it might be economical to use a pacca centering of planed boards nailed to a couple of ballies, with the top surface greased; this could be used over and over again.

The fixing in position of the reinforcement was a considerable puzzle. At the first attempt a framework of $1'' \times 1''$ angle iron was constructed to take the ends of the wires, but when these were strained the frame bent. Some old surplus channel iron, $4'' \times 2''$, was also used, but of course such material is not usually available. Moreover, experience proves that nothing should break the homogeneity of the slab, or cracks are likely to occur. The best solution appears to be to bend a piece of moonj ban (country rope) on to each wire, and tie it to a balli, which may either form part of the scaffolding outside the building or may merely hang down outside the wall up to which the roof is to extend, and be weighted. The wire may then be strained by hand until taut, and the other end fixed in a similar manner. With the former method of fastening the ends of the moonj ban, wire strainers may advantageously be used.

* *Vide* note at end.

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Some methods of treating the rolled steel beams are shown in *Figs.* 3, 5, 6. If the centering is supported on the lower flange of the beams, the method shown in *Fig.* 6 may be used, or the beam may be merely painted or coal-tarred, if the appearance does not matter. The system of *Fig.* 3 has the advantage of reducing the unsupported span.

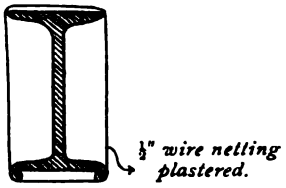

FIG. 5.

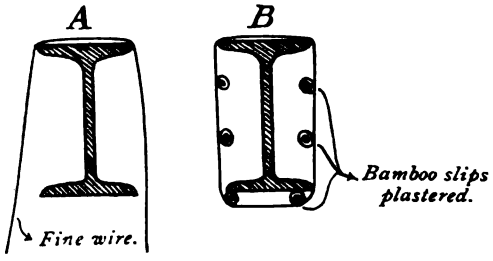

FIG. 6.

A. While centering is in position.
B. After centering is taken down.

The method of keeping the bent wire in position required some thought. The plan adopted, was to place a half brick on edge under the wire, where the latter passed over a support, while a strand of wire was passed along the support, under the half bricks and over the straight wires, to keep the latter down. At the point where the bent wire turned upwards a similar strand was passed over the bent and under the straight wires, and kept from rising too high, as it tended to do, by a couple of loops of wire or string, which were taken through the centering and tied to the ballies underneath.

The composition of the concrete varies in different districts. At Jhansi it consists of 40 parts by volume of pure kankar lime to 100 parts of broken brick or flint ballast.

In laying the concrete two points should be kept in mind. If the beams are to be embedded in concrete, this concrete should be laid first, and carefully packed. It is also necessary to see that the reinforcement is not displaced by the weight of the concrete. As the latter is being thrown down one man should stand by with a hook, pulling up the reinforcement into position.

After being laid, the concrete should be kept under water for 10 days. The water soaks through the concrete, carrying lime with it and depositing it in the minute interstices through which the water filters.

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At the end of the 10 days the surface is treated in the way shown in Appendix II.

The centering should be left in position for 10 days. Finally it is worth considering in what direction to look for future progress, or, in other words, for greater economy. Probably the most important item to attack is the rolled steel beams. The cost of $5'' \times 3'' \times 11$ lb. beams at 5′ intervals comes to about Rs.12 per 100 square feet of roofing. With a beam of 10′ span we can use $5'' \times 3'' \times 11$ lbs. up to $5\frac{3}{4}'$, and $6'' \times 3'' \times 12$ lbs. up to $8\frac{1}{2}'$ spacing, provided the slab is strong enough. This considerably reduces the expense. The same principle is true of larger spans and heavier beams. It will always be found economical to use the largest, or nearly the largest, spacing which the strength of the slab allows. Efforts must therefore be directed to increasing the safe span of the slabs. Now in working with these slabs the point which has to be taken into account is that where the first crack appears. This point is reached with from a third to a half of the breaking load, and may be considered as analogous to the elastic limit of steel. With the ordinary reinforcement used, the cracking load may be taken as 220 lbs. per foot super, and half of this may be considered a fair working load. In fact, this is probably a conservative estimate, for in practice the slab is made continuous, half the reinforcement being at the top of the slab at the point of support, while the experimental slab was only supported. As the working load is 75 lbs. (60 lbs. for the weight of the slab and 15 lbs. for the external load), it appears that a span of $5 \times \sqrt{\frac{110}{75}}$ or 6′ is perfectly safe. With a little corbelling it might be possible—by increasing the thickness of the slab to, say, 8″—to dispense with steel beams altogether in verandahs. It is impossible to say, without experiment, how far this would hold true; theoretically the weight would be increased from 75 to 95 lbs., the effective depth from 5″ to 7″, and the permissible span therefore to $6 \times \frac{7}{5} \times \sqrt{\frac{75}{95}}$ or $7\frac{1}{2}'$. The rolled steel beams may eventually be replaced by reinforced ones; experiments are now proceeding with a view to ascertaining how far this is practicable. Improved systems of reinforcement may also be discovered, the extra cost of which will be more than compensated for by the saving on rolled steel beams. There is probably room also for improvement in the centering, an item the cost of which is only exceeded by that of the rolled steel beams.

Note.—The prediction about reduction in cost, which was written in March, 1909, has been amply fulfilled in the time which has elapsed since then. It has been found possible to dispense with plastering the underside of the roof, thus saving Rs.3 to Rs.4 per 100 square feet, while a very considerable economy has been made as the result of increased familiarity with the work by those engaged on it. As an instance it may be mentioned that the cost of re-roofing a barrack verandah was reduced from Rs.5,000 to Rs.3,000.

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ADDITIONAL NOTE BY LIEUT.-COLONEL W. R. BRETT, R.E.

Lieut. Stoehr having asked me to peruse this article, I add the following notes, embodying the latest experience :—

1. It has been found best to build the concrete slab wholly above top flange of rolled steel beams, to avoid breach of continuity.

2. When the length of concrete exceeds 20′ in any direction an expansion joint must be given. This is simply done by leaving a ½″ gap to be filled with asphalte or other bituminous substance.

3. When turning a corner, such as verandahs, it is best to carry the armouring right across in both directions, forming a network This avoids straining beams, which are a source of weakness.

4. Parapets are best avoided. They hold up water, as the outlets are liable to be choked. The edge is best finished with a drip course of brick or stone, well corbelled out.

5. If parapets are dispensed with, the treatment of surface, described in Appendix II., is unnecessary, as the roof is quite watertight without.

6. I do not think that reinforced *lime* concrete can be employed in place of the rolled steel beams, but I am inclined to think that the span between beams can safely be increased to 6′, using precisely the same thickness of concrete and the same armouring.

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APPENDIX I.

SOME TESTS OF REINFORCED LIME CONCRETE SLABS.

Slabs.—5′ 6″ × 1′ × 6″.

Composition, of concrete, 100 of ballast of ¾″ or less, 40 of pure kankar lime.

Reinforcement.—1″ above bottom of slab, unless otherwise stated.

Load.—Rolled steel joists slung from a round steel bar placed across the centre of the slab.

Span.—5′.

First Batch (*made*, 23*rd October*, 1908; *tested*, 5*th December*, 1908).

Slabs kept wet for 14 days with damp grass.

1. *Reinforcement.*—Two strands barbed wire.
Ballast, flint.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
192 lbs.	Hair cracks appeared	134 lbs.
492 lbs.	Deflection 1¼″; cracks had steadily widened	254 lbs.
520 lbs.	Broke	*265 lbs.*

2. *Reinforcement.*—Two strands No. 4 7-strand galvanized iron wire.

314 lbs.	Hair cracks appeared	183 lbs.
782 lbs.	Deflection 2″; cracks had widened considerably	371 lbs.
858 lbs.	Deflection 3″	401 lbs.
876 lbs.	Broke after about 30 seconds through piece of concrete dropping out and remainder crushing	*412 lbs.*

3. *Reinforcement.*—As shown below:—

192 lbs.	Hair crack in centre, which had only slightly widened at 782 lbs.	134 lbs.
314 lbs.	Bad shearing crack appeared near one end	183 lbs.
558 lbs.	Bending deflection almost *nil* (⅜″) ...	280 lbs.
642 lbs.	Shearing crack about ⅛″ difference in level	313 lbs.
782 lbs.	Broke through shearing...	*371 lbs.*

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SECOND BATCH (*made, 23rd November*, 1908; *tested, 4th January*, 1909).

Slabs kept wet for 14 days by lime bunds full of water.

4. *Reinforcement.*—One barbed wire bent up 1′ 8″ from each end thus:—Ballast, flint.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
Nil.	Two fine cracks	57½ lbs.
113 lbs.	Crack in centre	103 lbs.
235 lbs.	Crack widened; deflection ¾″	151 lbs.
291 lbs.	Beam broke after about a minute through crushing of concrete ...	*174 lbs.*

5. *Reinforcement.*—One 7-strand G.I. fencing wire arranged as for 4.

Nil.	Two cracks nearly ¼″ broad, probably through rough handling in getting beam into position	57½ lbs.
169 lbs.	Width of one crack slightly increased; deflection 1″	125 lbs.
357 lbs.	Beam broke through concrete crushing. Wire remained unbroken ... ... Deflection 3″, and crack nearly in centre had developed.	*200 lbs.*

6. *Reinforcement.*—Two barbed wires, one bent up as in previous case, the other straight.

Nil.	One hair crack	57½ lbs.
113 lbs.	A hair crack near centre	103 lbs.
235 lbs.	Another	151 lbs.
357 lbs.	One crack slightly wider; deflection ¼″	200 lbs.
479 lbs.	Deflection ½″	249 lbs.
601 lbs.	Deflection ¾″; centre crack opened perceptibly as load was applied... ...	298 lbs.
723 lbs.	Beam broke as the extra 122 lbs. was being applied	*347 lbs.*

7. *Reinforcement.*—Two 7-strand G.I. fencing wires arranged as above. Owing to faulty construction the wires were exposed at the lower surface of the concrete for the centre 2′ of their length.

113 lbs.	Crack under one cross wire (where wire was bent upwards)	103 lbs.
235 lbs.	Deflection ½″, crack ¼″ wide; second crack	151 lbs.
479 lbs.	Broke after 10 seconds, apparently from wires slipping	249 lbs.

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8. *Reinforcement.*—As in 7, but ends fixed to L iron to prevent slipping.
Ballast, broken brick.

External Weight.		Equivalent Distributed Load per foot super, including Weight of Beam.
413 lbs.	Fine crack in centre, very fine hair crack under one cross wire; deflection $\frac{1}{16}''$	222 lbs.
479 lbs.	Deflection $\frac{1}{8}''$	249 lbs.
601 lbs.	Centre crack $\frac{1}{8}''$ wide; deflection $\frac{1}{4}''$ ...	298 lbs.
723 lbs.	Deflection $\frac{1}{2}''$	347 lbs.
779 lbs.	„ $\frac{3}{4}''$	369 lbs.
845 lbs.	„ $1''$	395 lbs.
1051 lbs.	„ $1\frac{1}{4}''$	478 lbs.
1089 lbs.	Beam broke after about $\frac{1}{2}$ minute through concrete crushing	*493 lbs.*

9. *Reinforcement.*—As in 8.
Ballast, purple flagging broken up.

235 lbs.	Two fine hair cracks; deflection $\frac{1}{16}''$ ...	151 lbs.
357 lbs.	Deflection $\frac{1}{4}''$	200 lbs.
479 lbs.	Crack in centre, $\frac{1}{8}''$ broad; deflection $\frac{1}{2}''$	249 lbs.
601 lbs.	Deflection $1''$	298 lbs.
723 lbs.	Broke after 5 seconds	*347 lbs.*

10. *Reinforcement.*—As in 8.
Ballast, flint.

535 lbs.	Hair crack in centre; deflection $\frac{1}{8}''$ ...	271 lbs.
601 lbs.	Crack slightly widened	298 lbs.
723 lbs.	Deflection $\frac{3}{8}''$	347 lbs.
845 lbs.	„ $\frac{1}{2}''$	395 lbs.
967 lbs.	„ $1''$	444 lbs.
1089 lbs.	Broke after about 10 seconds	*493 lbs.*

11. *Reinforcement.*—Expanded metal 6″ mesh, metal strips $\frac{1}{4}'' \times \frac{1}{16}''$.

Nil.	Fine crack from its own weight ...	57½ lbs.
255 lbs.	Crack $\frac{1}{16}''$ broad; deflection $\frac{3}{8}''$	151 lbs.
357 lbs.	Broke at once	*200 lbs.*

From these experiments, so far as they have gone, several conclusions can be drawn.

First, and most important.—Well-made concrete slabs, 6″ thick of 5′ span, reinforced by two No. 4 7-stranded G.I. fencing wires per foot, are perfectly safe. The breaking load per foot super is 493 lbs., as against an estimated working load of 72½ lbs., and external breaking load is 437 lbs., as against an estimated load of 15 lbs.

Second.—There is no fear of the reinforcement slipping provided that care is taken to bury it well in the concrete. No. 7 was the only instance where the wire slipped.

Third.—There is little or no reason to fear shearing stress.

Fourth.—Nearly all the beams broke through the crushing of the concrete. As the deflection increased and the cracks extended, the area

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of compression grew smaller and smaller, till at the breaking point it was usually only about 1" deep or less.

The way to increase the strength of the beam is to increase its stiffness.

Fifth.—The strength increases with the amount of reinforcement. No. 11 does not seem to confirm this, but its lack of strength appeared to be due to imperfect bonding of the concrete through the mesh, which made the beam act like three separate superposed beams.

Sixth.—From the fact that No. 7 was the only one in which adhesion proved deficient, it seems probable that it is unnecessary to tie the ends of the wires, and that No. 7 should have been as strong as No. 10. If we assume this to be correct, then it follows :—

Seventh.—The concrete should be laid in two layers, well rammed and kept covered with water. The concrete of the second batch was denser and of higher quality than that of the first, to which I attribute the greater strength of Nos. 6 and 7, as compared with 1 and 2.

Eighth.—The ballast used should be of different sizes. That for Nos. 8 and 10 was so, while that for No. 9 was of approximately the same size throughout. Broken brick is preferable to the flint used, as it gives a perfectly solid concrete, while the flint appears to have some voids.

Further experiments are to be made to test the system used in No. 3, and to test a different kind of lime. For the present Nos. 7, 8, or 10 are the systems in use.

APPENDIX II.

TREATMENT OF SURFACE OF TERRACED ROOF.

When the water, under which the roof is at first kept, is drained away, the surface should be rubbed with small slabs of stone. Any paste of lime which forms should be at once removed; if allowed to remain, it is likely to swell during the rains and break the skin of the roof, thus causing leaks. When the surface of the roof is perfectly clean, the following mixture should be applied and trowelled well until a smooth hard surface is formed :—

Ingredients dry in the following proportion by weight :—

Fresh kankar or boulder lime...	1 maund.	Linseed	1 seer.
Pulp of bael fruit	1 seer.	Urd-ka-atta ..	1 seer.
Gur (country sugar), 2 years old	5 seers.	Catechu or kaththa	1 seer.

Preparation.—Slake the lime and grind fine by hand. Add water till the liquid is of the consistency of whitewash, strain it through a coarse cloth, and store in tubs or nands. Dissolve the gur in a chattie with cold water. Tie the pulp of bael fruit, Urd-ka-atta, linseed, and catechu together in a cloth, and let them soak in water for about four days, when they will have rotted. Squeeze all the juice from this into the chattie in which the mixture has been soaking. Mix the whole together, and the preparation is ready for use.

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A NEW INTERNAL COMBUSTION PUMP.

By Lieut. G. L. Hall, R.E.

A PAPER was read before the Institution of Mechanical Engineers last November by Mr. H. A. Humphrey, dealing with a new type of internal combustion pump of his invention. The main principle of its action is the exertion of the explosive force directly upon the water itself, necessitating no rotating fly-wheel, solid piston, crank or other necessary adjuncts for converting reciprocating into rotary motion. So far, the action of the Humphrey pump is comparable to that of the well-known hydraulic ram, and in some degree also to that of the steam pulsometer pump. Internal combustion, direct-acting pumps on these lines have been tried experimentally as far back as 1868. But the Humphrey pump, as will be seen later, has one essential point of difference from all its prototypes.

Before proceeding further to describe the action of the new pump, it may be as well to consider the leading features of the hydraulic impulse ram and the steam pulsometer pump. The former utilizes the kinetic energy of a comparatively large volume of water, with small head, to raise a comparatively small quantity against a greater head. The kinetic energy of the water is commonly due to gravitation, as in the case of a stream.

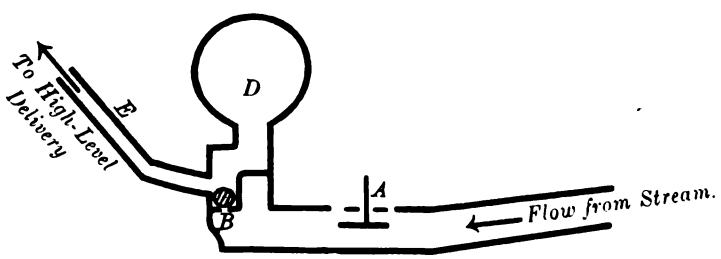

Fig. 1.

Fig. 1 will make the action clear. The valve A is of such a weight as to remain open against the static pressure of the stream water. The open valve A allows the stream to flow through it, and so to acquire kinetic energy sufficient to close A and to rush on through the ball valve B into the closed air vessel D, until the kinetic energy of the moving column of water is balanced by the pressure of air in D. The valve A then re-opens and the elastic air cushion in D expands, driving the imprisoned water up the delivery pipe E. Note the non-return valve B.

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The steam pulsometer pump is similar in principle, except that in this case the elastic fluid is steam, deriving its initial pressure not from the force of gravitation, but from a steam boiler. Steam expands on the free surface of the water, driving it past a non-return delivery valve against the head. The necessary suction for supplying a fresh charge of water to be pumped, is caused by the condensation of the steam and the creation thereby of a partial vacuum.

It will be noticed that in both the above types of pump there are no moving parts beyond the column of water itself and the valves. They both however, in common with nearly every type of pump, contain as an essential part of their working gear a non-return delivery valve. It is on this point that the Humphrey pump differs, its action depending on the fact that there is no non-return valve, and that a portion of the water pumped on one stroke returns to compress a combustible charge preparatory to the next stroke.

The earlier internal combustion pumps were all worked on the non-return principle, and the operation of such a valve with the explosive force behind it has always been disastrous.

We may now examine the action of the Humphrey pump in detail. A mixture of gas and air, previously compressed, is fixed electrically in contact with the water to be pumped in a closed combustion chamber A (see *Fig.* 2). The pressure so caused forces a column of water along a pipe line D and up to the high-level reservoir F without the intervention of any sort of delivery valve. This column of water acquires kinetic energy from the explosion, and continues to move along the delivery pipe, until it finally comes to rest. Owing to the considerable kinetic energy required by this moving column of water, expansion of the products of combustion is carried out to below atmospheric pressure. This partial vacuum has two effects, viz.:—(1). It allows the exhaust valve C in the combustion chamber to open by its own weight. (2). It admits a fresh charge of water from the low-level tank E through valve G. As soon as the column of water moving in an upward direction has come to rest, it at once commences to flow back to the combustion chamber. This closes the valve G and drives the fresh charge of water up into A, forcing out the products of combustion through the exhaust valve C. When the water reaches the level L, it closes C by impact and compresses the remaining products of combustion in the small space between L and K. On the pressure in this space rising above that due to the static head of water in F, the moving column of water flows back again towards F, again causing a partial vacuum in the combustion chamber, and allowing the inlet valve B to open against a light spring and so admit a fresh combustible charge : the valve C is meantime locked shut. The condition of affairs being still unstable owing to the unbalanced head in F, the column of water

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returns to compress the combustible charge at K, and a fresh cycle of operations is started.

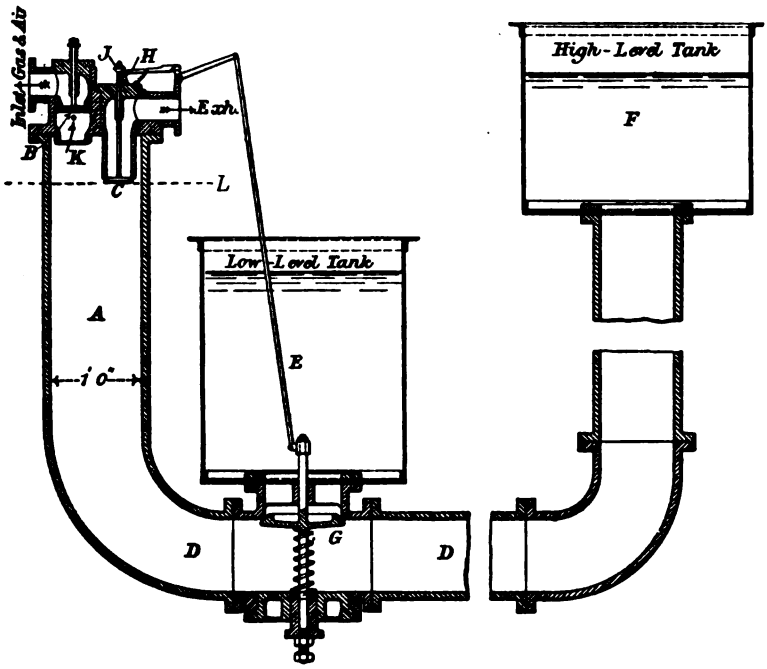

FIG. 2.—*Diagram of the first experimental Four-Cycle Pump.*

The action of the pump obviously depends upon the pendulum swing of the column of water backwards and forwards: in other words this column of water is a reciprocating fly-wheel. The expansion of the gases is carried out to below atmospheric pressure, a factor which contributes to a high thermal efficiency as compared with the Otto Cycle. Velocities are kept low to reduce skin friction to a minimum, and the movement of the water is used to control the pump instead of the pump controlling the movement of the water. A very ingenious ignition apparatus is fitted to ensure firing at maximum compression whatever this may be. By this means the head against which the pump works can be varied without any stop or alteration to the gear. Various interlocking gears are used between the suction and exhaust valves.

The above pump may be called a 4-cycle pump since there are two movements of the column of liquid in each direction for one complete cycle. Several types of 2-cycle pumps have been made, in which the cushion and suction stroke are suppressed. A diagram of one form of such a 2-cycle pump is given (*Fig.* 3), from which its action will be clear.

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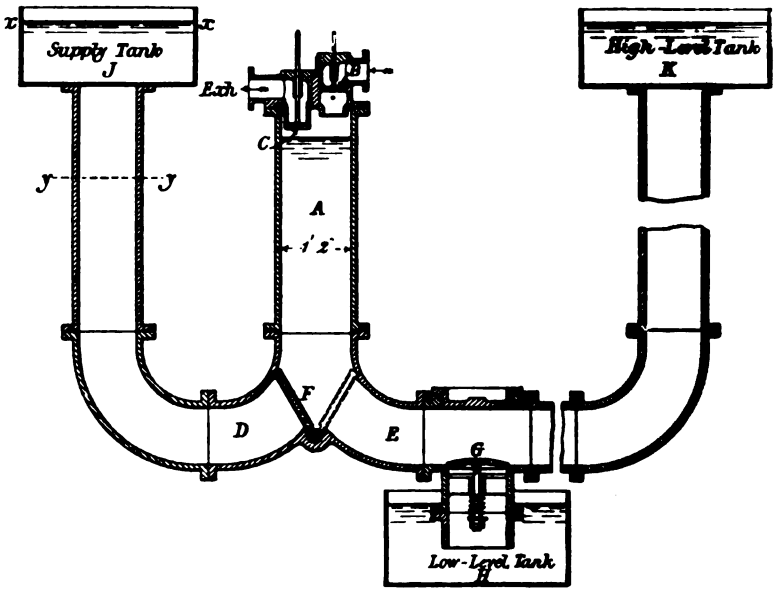

FIG. 3.—*Diagram of Two-Cycle Pump.*

The hinged valve F alternately places the combustion chamber in communication with the supply tank and with the high-level tank. It will be noticed that the supply tank J acts in exactly the same way as the high-level tank in the 4-cycle pump, in exhausting the burnt gases and drawing in a fresh charge of combustible mixture. No replenishment of the water in J is necessary as all pumped water is taken from H.

The fuel employed for the Humphrey pump is normally some form of producer gas: successful experiments have also been made with petrol supplied through a carburettor. Up to the time of the publication of the inventor's paper, neither town gas nor paraffin had been used.

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THE FYERS FAMILY.

(Continued.)

By Col. Robt. H. Vetch, c.b., late R.E.

Children of Alexandrina Fyers, Wife of the Rev. James Reid.

By the marriage, which took place, it is believed, somewhere about 1782, of Alexandrina Fyers—third daughter of Thomas Fyers, Overseer of the King's Works in Scotland, and of Elizabeth Falconer, his wife—with the Rev. James Reid, minister of the parish of Kinglassie in Fifeshire, there was a family of four daughters and two sons :—

I. Elizabeth Reid ; died unmarried.

II. Alexandrina Reid ; died unmarried.

III. Joana Reid ; married the Rev. J. Hutton, and had issue a daughter, Elizabeth, who died at the age of 15 years.

IV. Rose Reid ; died unmarried.

V. William Reid, Major-General, R.E., G.C.M.G., K.C.B., F.R.S. (see below).

VI. James Reid, who, it is said, entered the Royal Navy ; died young at Jamaica, West Indies.

Of the above family of Alexandrina Fyers one member alone demands special notice ; but of all the numerous grandchildren of old Thomas Fyers and Elizabeth Falconer this one is of surpassing interest, and occupies by general consent the most distinguished position.

Owing to the loss of the family papers in the great fire at the Pantechnicon, Baker Street, where they were stored, no life of Sir William Reid has been written. Major-General Whitworth Porter, however, in his *History of the Corps of Royal Engineers*, has given a short sketch of his career ; and I myself wrote a memoir of him in 1895 for *The Dictionary of National Biography*. There were also several obituary notices in journals and newspapers at the time of

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his death. Of these the notice in the *Proceedings of the Royal Society*, written by Major-General Sir J. H. Lefroy, K.C.M.G., R.A., is the most satisfactory.

On coming to his name in my article on "The Fyers Family," I intended to refer my readers to these sources of information about Sir William Reid, and I should have done so, had it not been for the remonstrance of my old friend, the late Major-General E. R. James, R.E., himself a member of the Fyers family. I went to see him last July just before he left town, and, as it proved, for the last time for it was but a few months before his death. He then urged me to take this opportunity to include in our own Corps Papers as complete a life of this distinguished officer as it might be possible to put on record. I told General James that I thought such a life would be too long for the *Royal Engineers Journal*, and would, perhaps, overweight the story of the Fyers family. However, he seemed to think that the history of the Fyers family with Sir William Reid's part omitted would be like the play of Hamlet with the part of the Prince of Denmark left out. So I left him saying I would consider what he had said. He wrote to me: "As regards my suggestion about Sir W. Reid, you may think Porter has sufficiently dealt with his memory, but the readers of your article will not take the trouble to look up Porter. . . . Sir W. Reid is one of my heroes. . . ."

Now, at best, Porter's sketch of Sir William Reid is a slight one. For particulars of Reid's brilliant services as a subaltern in the Peninsular War, which have seldom, if ever, been equalled by so young a soldier, the reader is referred to the history itself. He has in consequence a difficulty in realizing what those services were. He has to pick them out of the general narrative with some trouble, and probably fails to form an adequate conception of this important part of Reid's life. My own memoir in *The Dictionary of National Biography*, on the other hand, has the defects of a dictionary article in being greatly compressed. It is a bare narrative of dry facts and dates, probably suitable enough for its purpose, but necessarily omitting much that lends interest to a life when greater freedom is allowed to the writer. It assumes the reader's familiarity with the general course of campaigns and of events, and is only useful for reference as to Reid's part in them.

I was pondering over these considerations in connection with my friend's suggestion when, on taking up the newspaper, one morning I was shocked to see the announcement of his death. It was, I think, this rather sudden death of Major-General E. R. James in the autumn of 1909, before I knew that he had returned to town from a tour in the west of England, which decided me to do what he so greatly

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desired. So, with the acquiescence of the Editor, I propose to give as full an account of Sir William Reid as the materials at my disposal will allow.

For several reasons I find it necessary to keep before the reader the general operations of the campaigns in which the subject of my notice was engaged, and to refer in some detail to the movements of the army. I have already adopted this course in my notices of Lieut.-General William Fyers in the American War of Independence and in the Walcheren Expedition; of Major-General Thomas Fyers in the retreat of Sir John Moore to Coruña; and of Lieut.-General Sir W. A. Fyers in the campaigns of Afghanistan and the Crimea. In the case of Major-General Sir William Reid it is equally desirable, because when not engaged at sieges he was attached to a division of the army, and his activities can only be properly followed by observing the movements of the division to which he was attached. It so happens that all Reid's papers having perished I have to fall back on official documents, diaries and letters of his brother officers, and the history of the campaign for information as to his doings. Although in the ordinary way the war experiences of a junior officer must be gathered from the performances of the troops with whom he served, fortunately in Reid's case he was so often brought into prominent positions—either at sieges as a leader of storming parties or by individual enterprise in the trenches, or in the field as the senior officer of Engineers with the force to which he was attached, and therefore in close touch with his general—that his merits were known to his seniors as well as to his brother subalterns, and his name appears both in the journals of sieges and the despatches of commanding officers.

Major-General Sir William Reid, R.E., G.C.M.G., K.C.B., F.R.S.

Major-General Sir William Reid, elder son of the Rev. James Reid, minister of the Established Church of Scotland, at Kinglassie, Fifeshire, by his wife Alexandrina Fyers, third daughter of Thomas Fyers, Overseer of the King's Works in Scotland, and of his wife, Elizabeth Falconer, was born at the Manse, Kinglassie, on the 25th April, 1791. The family of Reid, from which he sprang, was formerly of Barra Castle, Aberdeenshire, and a baronetcy had not long become extinct in the family. Barra and the adjoining property then passed from the Reids to the Irvines of Drum, Aberdeenshire.

William Reid received his early education at a private school at Musselburgh, in Mid-Lothian, and afterwards at the Edinburgh

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Academy. In 1806, having passed the entrance examination he joined the Royal Military Academy at Woolwich as a Gentleman Cadet. Before leaving it he was sent, as the custom was at that time, to the Ordnance Survey, under the direction of Lieut.-Colonel William Mudge, Royal Artillery, where he learnt practical surveying. Reid was commissioned as 2nd Lieutenant in the Corps of Royal Engineers on the 10th February, 1809, and was ordered at once to Dover to take the place of his cousin, friend, and contemporary, Edward Fyers (*q.v.*), who was about to embark for the Peninsula.

A year later Edward Fyers had returned home invalided, and Reid himself was ordered to Lisbon. He arrived there on the 28th March, 1810, in company with two captains and six other subalterns of his own Corps.* This large draft of Engineer officers was sent out on the urgent application of Lord Wellington for more Engineer officers. He had to send several officers of the Corps to Cadiz† and required additional officers for the construction of the famous Lines of Torres Vedras then in progress.

The object of these Lines was to enable the British Army to hold its own in front of Lisbon until the Spanish Army could be made a more efficient and useful ally than it had hitherto proved to be. After the Battle of Talavera (27th July, 1809), when General de Cuesta, commanding the Spanish Army, refused to co-operate with the British, Lord Wellington saw that the next campaign must be fought on the defensive, and that preparation must be made in the meantime for a future struggle with the enemy on more equal terms.

As no hope of successfully defending an extended and open frontier, like that of Portugal, against so superior and so skilful an enemy as the French could be seriously entertained, Wellington found a position in the lower part of Estramadura, which could neither be turned nor passed, and while it enjoyed an assured communication with the sea, also commanded all the approaches to Lisbon. This position he decided to re-trench in the strongest manner so that it might serve as a point of concentration for the whole of the defensive forces of Portugal, where the allied armies could be victualled and supplied to any extent and for any period of time, whilst, at the same time,

* Sir John Burgoyne writes in his journal: "3rd April, 1810. Capts. Squire and Holloway, and Lieuts. Meineke (King's Hanoverian Legion), Dickenson, Trench, Piper, Tapp, Reid, and Hulme, of the Engineers, arrived at Lisbon on the 28th ult."

† Burgoyne writes in his journal: "3rd April, 1810. Lefebure, of the Engineers, with the rank of Major, and Bird, Nicholas, Wells, etc., are gone to Cadiz."

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they held the most favourable field for deciding the fate of the capital in a general action.

Whilst the army was cantoned on the Guadiana in October, 1809, Lord Wellington, with his Quartermaster-General, Colonel Murray, and his Chief Engineer, Lieut.-Colonel Fletcher, made a reconnaissance of this position in front of Lisbon. He gave orders for the construction of a chain of fortified posts across it from the Atlantic to the Tagus, leaving it to his Chief Engineer to work out the details. These works were in full swing when Reid and his brother officers arrived at Lisbon.

The Lines of Torres Vedras consisted of two distinct lines of defence from 20 to 30 miles in front of Lisbon. The outer line extended from Alhandra on the Tagus to the mouth of the Zizandra River on the Atlantic coast, and was nearly 30 miles long. The inner line, from 6 to 10 miles in rear of the outer, stretched from Quintella on the Tagus to the mouth of the St. Lorenza River on the Atlantic coast, and was some 24 miles long. There was besides an entrenched camp formed at Fort St. Julian at the mouth of the Tagus some 10 miles below Lisbon. This was intended to cover a forced embarkation of a large force in case of necessity.

Two months later Lieut.-Colonel Fletcher and his three senior officers—Capts. Chapman, Squire and Goldfinch—were recalled to Army Headquarters and to active operations on the Coa. Capt. (afterwards Colonel Sir) John Jones was then left in charge of the construction of the Lines of Torres Vedras. His officers were three captains, and eight subalterns, of whom Reid, who had been promoted 1st Lieutenant on the 23rd April, 1810, was one. Some 150 soldiers of the Line, principally artificers selected from the regiments at Lisbon, assisted these officers. These men were under the charge of a captain stationed at Mafra and a subaltern at Alhandra, but were divided into parties of two and three men each throughout the whole of the position. "In some of the districts," says Sir John Jones, "a subaltern officer of Engineers with that small number of English soldiers, utterly ignorant of the language, directed and controlled the labours of a thousand, or fifteen hundred peasantry, compelled to work, many at the distance of 40 miles from their homes. . . . The young officers now, for the first time, placed in charge of extensive districts, exerted themselves with a zeal which knew no limits, and everywhere throughout the Lines a spirit of honourable emulation proved highly advantageous to the progress of the work."

A young Scotsman, only 19 years old, full of life and energy, Reid was soon to make his mark. Among his comrades he was known to have a good head upon his shoulders, and was in other respects a general favourite. Among his seniors he was regarded as a youngster

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upon whom they could rely in emergency, a hard-working, shrewd young officer, who would carry out his work strenuously, conquering, or ignoring, difficulties, and not at all afraid of accepting responsibility when necessary.

His duties lay at first at Fort St. Julian, covering the place of embarkation on the Tagus in case of defeat; at another time at Mafra and the Passes of Morugueira and the works along the ravine to the left. From these he went to the extreme left of the *outer* line to take charge of the redoubts and entrenchments at the position of S. Pedro da Cadeira, which rested on the Atlantic Ocean on the west, and extended to the eastward for some miles up the river Zizandra. The main redoubt was on a commanding eminence in the centre of the position, overhanging the river where it makes a bend of nearly a right angle.

In September, 1810, in addition to his own charge of the S. Pedro da Cadeira position, he was directed to take temporary charge of the district which embraced the works on the extreme left of the *inner* line, extending from Ereceira on the Atlantic Ocean inland to beyond Mafra, on account of the officer in charge, Lieut. Hulme, R.E., having been ordered to Lisbon.

The following is a letter from Reid to his Chief on the subject of this new charge:—

"ST. PEDRO DA CADEIRA, *6th September*, 1810.

"DEAR SIR,

"After I sent off my letter to you last night, I received a letter from Lieut. Hulme to say that he had received your orders, through Lieut. Stanway, to show me the mines and everything to be done in that district, and then that he was to go immediately to Lisbon; I therefore went over the Ereceira works with him to-day. You had desired him to form an abattis from Morugueria to Ribarmar: this I shall begin immediately, though I must say I have not all the confidence I could wish. If you have time, I would be much obliged to you for some further instructions; however, as I conceive that there is no time at present for delay, I shall go over the Morugueria ground to-morrow, and the instant I can collect cars and men I shall begin at that place, and form a connected line from one redoubt to the other, breaking it in such places as will give me the most advantageous flank in front of my trees. I shall most anxiously look out for a note from you to say if this is what you wish.

"I remain, etc.,

"(Sd.) WILLIAM REID, *Lieut., R.E.*

"CAPT. JONES, Commg. Engr.

"P.S.—The two redoubts of Lieut. Thomson, near this, I expect are this night completed with plank platforms."

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At this time the premature fall of Almeida on the 27th August had compelled the British Army to fall back, and as it retired leisurely towards the Lines, every effort was made to complete the works. Various services had been left over to the last, such as levelling obstructions to fire, felling trees in front of the works, forming abattis, breaking up roads, destroying bridges, preparing and charging mines.

On the 7th October, Sir John Jones tells us, that "every preparation for defence was as complete as any longer delay could have rendered it," and on the following day the army, consisting of 22,000 British infantry and 3,000 cavalry, with about a similar number of Portuguese infantry, entered the territory thus prepared for their reception and support. The troops fully expected to be at once ordered to take up the ground to dispute the principal passes with the enemy. But in consequence of the steady discipline and assurance of the retreating British Army, and the lesson the enemy had received at Busaco, the French displayed no eagerness to press on. Lord Wellington therefore decided to halt at Sobral. He established his personal headquarters at Pero Negro in its rear, and was able to communicate with all parts of the Lines by signal from Monte Agracia. The redoubts and defensive works were garrisoned with Militia and the active army distributed as a field army.

As the subject of this notice took such an active part in the construction of these Lines I make bold to quote Sir John Jones and Sir William Napier on the state of preparation that had been attained in order to give the French a warm reception after the arrival of the British Army within the Lines. He says in his memoirs :—

"Happily every measure was complete, the new works armed, the ammunition placed in the magazines, with provisions and water in each redoubt, the abattis formed, the roads and bridges mined and charged for explosion, telegraphs established, and mounted guides held in readiness to meet the retiring columns and conduct them to their respective points of defence, when, on the day previous to their approach, the forerunners of the army, and immense crowds of fugitive Portuguese—men, women, and children—blocked every road, set all authority at defiance, and rendered further exertion impossible. The autumnal rains set in at this very moment, pouring down in torrents, accompanied by severe thunder and lightning, filling the streams and water courses, and rendering the roads deep and heavy, and furthermore putting the solidity of the field defences to the severest test. Notwithstanding this *contretemps*, and the pressure of the terrified and confused rabble which poured in on every point, no error of arrangement occurred, and each column reached the ground assigned to it with regularity and precision, and when the French

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approached, presented such a formidable appearance that Massena, after making a close personal reconnaissance, ordered his army to halt."

Napier in his history writes :—

"These celebrated Lines were great in conception and execution, more in keeping with ancient than modern military labours. . . . But to occupy 50 miles of fortification, to man 150 forts, and work 600 guns required many men, and numbers were not wanting. A great fleet in the Tagus, a superb body of Marines sent out from England, the Civic Guards of Lisbon, the Portuguese Heavy Artillery Corps, the Militia and Ordenança of Estramadura, furnished a powerful reserve to the regular army. . . .

"Massena surprised at the extent and strength of works which he had only heard of five days before he came upon them, employed several days to examine their nature. . . . Romans never raised greater works in the time."

The French armies in the Peninsula, although overwhelmingly superior to the British in point of numbers, were in great distress at this time. The troops were months in arrears of pay and, in general, very badly clothed. There was a scarcity of horses, carriages, and equipments of every description ; they subsisted solely on plunder, either individual, or by way of requisition. Scarcely any money came from France and little from Spain. This state of affairs made Marshal Massena desire to remove the consequent evils, which threatened the discipline of his army, by an expedition into Portugal and the plunder of Lisbon and Oporto. In opposition to every military principle he continued to advance on Lisbon, driven by the pressure of financial difficulties. His army consisted of 55,000 men, while the effective strength of the British Army was 29,000. On the 13th October he reached the village of Sobral which, being just outside the line of defence, was abandoned to him without a struggle. He then closed up to the Line so as to threaten every part of it from Zibriera to Alhandra.

The development of Massena's dispositions caused a great deal of work in strengthening various positions which were threatened by the enemy, and Reid and his brother subalterns found as much to do as they could possibly get through. "Every morning, two hours before daybreak, the troops stood to their arms at the point of assembly of their several cantonments, as did also the garrisons of the works ; Lord Wellington, in person, being in the fort on Monte Agraçia, in readiness to direct any general movement according to the

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exigencies of the moment. The army thus remained under arms till a communication from every portion of the Line, and ocular demonstration had assured the commander that no change had taken place in the disposition of the hostile troops, nor any preparation been made for immediate attack; the several divisions and brigades were then ordered to resume their daily labours of strengthening their respective fronts, making lateral communications, improving the roads, sheltering and securing their outposts, etc."

Massena made a close reconnaissance of the Lines on the 16th October in person; a shot fired at the party struck a wall on which the Marshal was resting his telescope, when he acknowledged the warning by taking off his hat and moving on. This reconnaissance convinced him that an army posted in such a strong position, supported by such formidable defences, would prove much too hard a nut for him to crack, and he turned his attention to subsisting his army till reinforcements could arrive. After exhausting the country his troops became sickly and he retired on the night of the 14th November towards Santarem, and next day was followed by Wellington. During the winter the two armies remained, one on each side of the Rio-maior, watching each other.

In his despatch to the Earl of Liverpool from Cartaxo, 21st November, 1810, Lord Wellington says:—

"Having advanced from the positions in which I was enabled to bring the enemy to a stand, and to oblige them to retire without venturing upon any attack, it is but justice to Lieut.-Colonel Fletcher, and the officers of the Royal Engineers, to draw your Lordship's attention to the ability and diligence with which they have executed the works, by which these positions have been strengthened to such a degree as to render any attack upon that line occupied by the allied army very doubtful, if not entirely hopeless. The enemy's army may be reinforced, and they may again induce me to think it expedient, in the existing state of affairs in the Peninsula, to resume these positions; but I do not believe they have it in their power to bring such a force against us as to render the contest a matter of doubt. We are indebted for these advantages to Lieut.-Colonel Fletcher and the officers of the Royal Engineers, among whom I must particularly mention Capt. Chapman,[o] who has given me great assistance upon various occasions."

On the 5th March, 1811, finding his supplies diminishing and the number of his sick increasing, Massena began his retreat. He was pursued by Wellington who, in the course of a month, for the second time drove the French out of Portugal. As Reid was still in the

[o] Afterwards Lieut.-General Sir Stephen Remnant Chapman, K.C.H., C.B., Colonel Commandant, Royal Engineers.

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Lines of Torres Vedras, there is no occasion to do more than refer to this famous retreat. In the meantime the French under Mortier had captured Badajos and Wellington determined to retake it. Reid was one of the officers of Royal Engineers who took part in the siege operations. Lieut-Colonel Fletcher commanded the Corps and Capt. Squire was director of the attack on Fort Christoval. There were 8 other captains and 11 subalterns employed. One captain and 1 subaltern were killed and 1 captain and 1 subaltern were wounded in the course of the siege.

Badajos was a large fortified town on the left bank of the Guadiana River, having a bastioned trace all round its land front, with outworks in the centre of the south front and on the south-east. A castle stood on high ground within and on the west of the enceinte. Opposite, on the heights on the other side of the river, was Fort Christoval. Communication between the town and Fort Christoval was by a bridge, 600 yards long, with a *tête de pont* on the Christoval side.

It was decided to attack Fort Christoval first. Ground was broken on the 8th May, 1811, and a parallel and abattis were begun by Reid under the orders of Capt. Squire at a distance of 450 yards from the fort. Owing to the rocky nature of the ground progress was very slow and cover could not be obtained for the guard of the trenches, which had to be retired behind the reverse slope of the hill. The garrison soon became aware of the state of affairs and on the 10th made a daring and vigorous sortie. Reid was the Engineer officer on duty in the trenches at the time. He sent for the guard of the trenches at once, but in the meantime, he formed up the picquet and working party, and gallantly charged and drove back the enemy. In doing so he was wounded in the knee.

Colonel Harcourt of the 40th Regiment, who was in command of the guard of the trenches, came with his men to Reid's assistance as soon as he could and completed the rout of the enemy. He was himself wounded. He wrote a handsome letter to Capt. Squire, R.E., in praise of Reid's conduct on this occasion. The following is an extract from the report of the Commanding Royal Engineer on the subject:—

Extract from the Report of Lieut.-Colonel Richard Fletcher, R.E., to Lieut.-General Gother Mann, Inspector-General of Fortifications, on the first Siege of Badajos.

"On the morning of the 10th (May, 1811) the enemy made a sortie on one of the batteries under the direction of Capt. Squire (R.E.), and I have much pleasure in enclosing a copy of a most honourable testimonial as to the conduct of Lieut. Reid on that occasion."

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Unfortunately the enclosure is missing.

On the 17th May, 1811, Capt. John Squire, R.E., wrote from Elvas to Colonel (afterwards Lieut.-General) William Fyers :—

"It is with the most heartfelt satisfaction I enclose the original letter which was addressed to me by Colonel Harcourt of the 40th Regiment, who was wounded in the sortie from Fort Christoval on the 10th May. It relates as you will perceive to your relative, Mr. Reid, whose excellent conduct is the subject of universal praise. I have preserved copies of the enclosed letter which I have also forwarded to some persons in England of high rank, who may perhaps be disposed to recollect this trait of zeal and gallantry. Mr. Reid has been slightly wounded, but in a day or two I hope he will be again on the effective list.

"The handsome testimony of Colonel Harcourt does high honour to himself as well as to the subject of his letter.

"The merits of Mr. Reid which are really great ought not to be passed over; he ought to be made a Brevet Captain; he has earned that honour.

"In our late attack of Fort Christoval we have had severe losses; poor Capt. Dickenson, my dear and intimate friend, torn from his country at the commencement of what I am sure would have been a brilliant career.

"But Badajos must yet be taken. I beg to be remembered to your family and am

"Your very faithful servant,

"JOHN SQUIRE."

His uncle, Colonel (afterwards Lieut.-General) William Fyers, who was then Deputy-Inspector-General of Fortifications, wrote from London to congratulate Reid :—

LONDON, *4th June*, 1811.

"MY DEAR WILLIAM,

"I have only time to thank you for your interesting letter of the 15th May (which has been read with much satisfaction by Lord Mulgrave. General Morse, etc.), and to congratulate you on the heroic *début* you have made when you 'flashed your maiden sword' at Badajos. The flattering testimonial of your achievement there, which I received enclosed in a friendly letter from Capt. Squire, brought tears from my eyes—and I doubt not the joy of having a son who so early distinguished himself will produce the same effect on your father and mother when they shall be informed of it—'*Perge decet.*' . . .

"I have made up a package of what newspapers I have and an Army List which I beg Lieut. Elliot to take charge of for you. My daughters are well, that is to say Anne and Louisa, the only two that are with me. Fanny is with her aunt at Maryfield.

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"All friends in Scotland are well, but I am grieved to tell you that poor Edward (his younger son in the R.E.) has had a relapse of his brain fever, and was very ill with it at Jersey when the last accounts arrived. This was predicted as a probability by Mr. Webb, and was the reason of my not sending him to join the army in Portugal. I have however great hopes it will not be of long duration. Remember me kindly to Squire, and give him many thanks for his friendly and truly obliging attention in your business. Remember me also particularly to my friend Jones, to Colonel Fletcher, Boteler[o] and all of the Corps whom I am acquainted with. I trust by this time you are effective, though a hurt on the knee is likely to be troublesome. God bless and preserve you, my dear William, and believe me

"Your ever affectionate uncle,

"WM. FYERS."

The first Siege of Badajos was raised on the 13th May, 1811, on account of Marshal Soult's threatening movements, but after Soult's defeat at Albuera by Marshal Beresford on the 16th of that month, the second siege was begun on the 19th May by a partial investment of the fortress, which was completed on the 25th.

At this second siege Lieut.-Colonel Fletcher was again in command, with Capt. Squire as director of the attack on Fort Christoval and Capt. Burgoyne as director of the attack on the castle; there were besides 8 captains and 10 subalterns of the Corps employed, of whom 1 captain was mortally wounded, and 2 subalterns were killed. Trenches were opened in front both of Fort Christoval and of the castle on the 30th May. In spite of his lame leg Reid took his turn of duty in the trenches in front of Fort Christoval. The batteries opened fire on the 3rd June and an unsuccessful assault was made on Fort Christoval on the night of the 6th when Lieut. Forster, R.E., who led the ladder party, was killed. Another unsuccessful assault on Fort Christoval took place on the night of the 9th June when Lieut. Hunt, R.E., was in charge of the ladders and was killed. On the morning of the 10th June Wellington assembled the senior officers and told them he had decided to raise the siege. He gave the following reasons for this decision:—The impossibility of getting possession of Fort Christoval without sapping up to the crest of the glacis, the imprudence of attempting to storm the castle without first taking Christoval, and finally the approach of the French armies in such force that prudence would not allow him to be caught by them in the midst of a siege. The last reason was no doubt the most important.

[o] Lieut.-Colonel Richard Boteler, R.E., then a 2nd Captain. He was lost in the wreck of the *Calypso* in February, 1833.

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In a despatch to Lord Liverpool he sent an appreciation of the work of the officers of Royal Engineers who had been employed at the two sieges. The British forces had no sooner retired with all their guns and stores to Elvas than Badajos was occupied by Marshals Soult and Marmont, who entered it on the 19th June.

After raising the siege Wellington retained his army on the Cayo to cover the Alemtejo provinces till the armies of Marshals Soult and Marmont should separate. When this took place on the 23rd July, Soult moving to Seville and Marmont re-crossing the Tagus, Wellington moved his army to Portalegre. In the middle of August he moved north and cantoned it between the Coa and the Agueda with a view to investing Ciudad Rodrigo. Reid was employed at first with the 3rd Division under Picton in strengthening the position on the heights of Guinaldo. On 1st September Burgoyne writing to Squire from Albergaria says "Reid and Wright are with me here." He was then preparing materials for the Siege of Ciudad Rodrigo.

Towards the end of the year Reid was attached to the force observing the Lower Agueda under Don Carlos d'España, who harassed the rear of Dorsenne's Army and captured provisions and money contributions it had raised. In December Reid was directed to mine the bridges of Yecla and Serrada, which spanned the Yebra, a branch of the Douro river between Salamanca and Ciudid Rodrigo. His working party consisted of Spanish miners with some sappers as overseers. Owing to the extraordinary hardness of the cement it required a fortnight's unceasing toil, day and night, to drive the shafts. When the mines were fired in the following spring they were most effective. One of the arches of the Yecla bridge was blown away, and a pier and two arches of the Serrada bridge were destroyed. General Don Carlos strongly recommended Reid to the notice of Lord Wellington for his zeal and skill. In consequence Reid was mentioned in his lordship's despatch. In November Capt. Squire wrote to Reid from Portalegre, and the letter breathes so thoroughly the spirit of a true friend that I give it in full :—

Letter from Capt. John Squire, R.E., to Lieut. William Reid, R.E.

"PORTALEGRE, *November 30th*, 1811.

"MY DEAR REID,

"I have received your letter of the 25th inst. I never mentioned to you that I had written to three or four persons of some consequence in England relative to your conduct in the sortie against our battery at Christoval. I frankly told them my real sentiments—that you ought immediately to be promoted to the rank of Captain. To these applica-

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tions I have received no answer, and now probably never shall. To say the truth I was not disappointed, for such is unhappily our present system that noble birth and great interest have far greater weight with our men of power than real merit.

"Do not however be discouraged; continue in the line you have begun, and you will eventually succeed, and if you do not obtain great honours and great riches, you will have the sweet reflection—which nobody but yourself can cause, and which no one on earth can take away—that of having done your best for the service of your country. If you do not gain promotion you will have the consolation of knowing you deserve it. So that labour away, as hard as you possibly can; seek every sort of useful knowledge and try to become one of the first officers in the world.

"I should not have alluded to the subject with which you began your late letter, had you not first touched upon it yourself. Do not be sanguine in your expectations; if you do succeed I shall be quite happy, and I beg you to inform me if you find there is the least prospect.

"I thank you for your account of what is going forward in your neighbourhood; it will give me great pleasure occasionally to hear from you. I am glad you are with Don Carlos. You will find him a fine soldier.

"The sailors did not tell you the truth about Capt. Nixon, of ye 85th; he has never been at Madrid; a few days ago he was exchanged from Badajos, and is now at Portalegre; he has lost his right arm.

"Castaños and his Staff are now with us; they set off to-morrow for Aldea del Bispo. Since our little enterprise against Girard,* nothing new has occurred here. The Conde de Penne (Villemur) is at Caçeres, and draws his supplies from the Department of La Serena. Marmont with Clausel's Division is at Abila. The enemy have made a lunette on the height where our battery was in front of Fort Christoval, and they have thrown out three countermines between the Pardaleras and the river. They have also raised the counterscarp in front of our breach in Fort Christoval.

"Believe me, ever very sincerely yours,

"JOHN SQUIRE."

On the back of this letter Sir William Reid has written "Squire died a Lieut.-Colonel, and is buried in Truxillo in Spain. . . . He was one of the most distinguished officers of the Duke of W.'s Army."

* Girard's Division was surprised by General Hill with the British 2nd Division from Portalegre and defeated on the 28th October at the little town of Arroyo de Molinos, when Generals Brun and D'Ahremberg with 1,300 prisoners, 3 guns, and the whole of the baggage were captured.

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In view of his decision to recover Ciudad Rodrigo Lord Wellington had ordered a battering train and engineer stores to be sent from Lisbon by sea to Oporto, as soon as the Siege of Badajos was raised. From Oporto they were moved in boats up the Douro to Lamego and thence by land to Villa de Ponte. It was not until December that final preparations were made for the siege, and even then it was in the nature of a secret, and the French were quite unprepared.

Ciudad Rodrigo is a fortified town on rising ground on the right bank of the Agueda River; it is enclosed by a double enceinte, Lieut.-Colonel Fletcher commanded the Engineers and Capt. Burgoyne was director of the attack. There were 8 other captains and 9 subalterns of the corps employed at the siege. Of these 1 captain and 1 subaltern were killed, and 5 subalterns were wounded. One of these five was Reid.

The Upper Teson Hill, on which was a redoubt, facing the town on the north, was carried by assault on the night of the 8th January. 1812, when Lieut. Thomson, R.E., who led the ladder party, was wounded. Ground was at once broken and a lodgment made. On the following night a parallel and batteries were begun and Capt. Ross, R.E., was killed by a grape shot.

Between 10 and 11 a.m. on the 14th January the garrison made a sortie with about 500 men. The time selected was during the relief of the divisions, when a bad custom prevailed that, as soon as the division to be relieved saw the relieving division approaching, the guards and working parties were withdrawn from the trenches. The works were thus left unguarded for some time during each relief. The garrison had a look-out on the steeple of the Cathedral from which this custom had been observed. The sortie succeeded in upsetting most of the gabions placed during the preceding night in advance of the first parallel. Some of the enemy even penetrated into the right of the parallel and others would have pushed into the batteries and spiked the guns had it not been for Reid. He hastily collected some of the working party that was being relieved, manned the parapets and kept up such a steady fire as to compel the enemy to halt when within a few yards. On the approach of Lieut.-General Graham with the relieving division the sortie retired into the town with little loss.*

That same morning, Lieut. Skelton, R.E., who was superintending

* Major-General Porter, in a footnote to p. 283, Vol. I., of his *History of the Corps of Royal Engineers*, assumes that it was either Capt. Mulcaster or Lieut. Skelton, R.E., who was the hero of this incident. The letter from Capt. Squire of the 23rd February, 1812, given below, makes it clear that it was Reid.

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the labour of opening and lining the embrasures of the batteries, under a heavy fire, was cut in two by a cannon ball; but in spite of delays the batteries opened fire in the afternoon.

On the night of this 14th January Capt. Mulcaster, R.E., was wounded in the thigh by a musket ball; on the night of the 16th Lieut. Marshall, R.E., was struck in the head by a bullet while instructing the sappers to break out the sap; on the night of the 17th Capt. M'Culloch, R.E., had his jaw broken by a cannon shot; on the 19th the breaches were effective and the assault was made that night on both the great and little breaches. Reid took part in the assault of the latter. Both assaults were entirely successful. In leading the column to the great breach Lieut. Thomson was wounded severely and Reid was wounded in the leg at the little breach by a bullet which was never extracted.

In his despatch to the Earl of Liverpool announcing the capture of Ciudad Rodrigo, Wellington refers to the conduct of the officers of Royal Engineers employed at the siege as worthy of being brought to Lord Liverpool's notice, and adds: "The ability with which these operations were carried on exceeds all praise."

By the 7th of February Capt. Burgoyne was able to write: "Mulcaster,* McCulloch,† and Reid are getting on well, but of poor Thomson‡ I fear there are little hopes, Dr. Gunning having declared that now his leg must be prepared for amputation."

After the ruined defences of Ciudad Rodrigo had been repaired and strengthened, the fortress was handed over to a Spanish garrison. Reid and his brother officers of the Engineers were then moved to Elvas, where preparations for the third Siege of Badajos were in hand.

Capt. and Brevet Major Squire, R.E., wrote to Reid from Portalegre:

Letter from Major John Squire, R.E., to Lieut. W. Reid, R.E.

"PORTALEGRE, *February 23rd*, 1812.

"MY DEAR REID,

"Though I have not written to you, believe me, I have made frequent enquiries after you, and am very happy to hear that you are likely soon to be recovered and to be again useful to the Service. I have heard that you distinguished yourself during the Siege (of Ciudad Rodrigo) by rallying the soldiers, and repulsing the sortie made by the enemy.

* Capt. E. R. Mulcaster was killed at the third Siege of Badajos on the 25th March, 1812.

† Lieut. William M'Culloch died at Athlone on 10th February, 1814.

‡ Lieut. Alexander Thomson survived, and died, a Captain and Brevet Major, in Edinburgh on the 20th June, 1830.

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"Your letter describing the affair of Don Carlos with the French I received only about three weeks ago. I wish Lord Wellington could move to Salamanca and lay hold of the magazines, which the French have established there.

"We are now it seems preparing for the Siege of Badajos. Do you think we shall take it or not? Macleod* passed through this place yesterday on his way to Elvas; he gave me a long history of your proceedings before Ciudad Rodrigo. Let me hear from you, and believe me to be

"Yours very sincerely,

"JOHN SQUIRE."

Reid had now made his mark and shown of what metal he was made. He had on several occasions displayed conspicuous gallantry. His indefatigable energy, no less than his coolness under fire, had attracted the attention of his superiors. His Chief, Lieut.-Colonel Fletcher, wrote officially from Elvas, where headquarters had been established during the third Siege of Badajos, to the Inspector-General of Fortifications, to endeavour to obtain brevet promotion for him.

Letter from Lieut.-Colonel Richard Fletcher, Commanding Royal Engineer with the British Army in the Peninsula to Lieut.-General Gother Mann, Inspector-General of Fortifications.

"ELVAS, *15th March*, 1812.

"SIR,

"I take the liberty to recommend to your consideration the peculiar merits of Lieut. Reid, of the Corps of Engineers.

"This valuable officer was mentioned in the highest terms by Lieut.-Colonel Harcourt, commanding the 40th Regiment, for his conduct during a sortie made by the enemy at the Siege of Badajos, in the month of May, 1811. A copy of the Lieut.-Colonel's report on this occasion I had the honour to forward to your office.

"About three months ago, Lieut. Reid was named to Lord Wellington in the strongest manner by General Don Carlos d'España of the Spanish Service, for his ability and zeal during an expedition under that officer, and he was afterwards particularly mentioned in his lordship's despatch.

"During the late Siege of Ciudad Rodrigo (at which he was wounded), his conduct was such as to add greatly to his former claims.

* Capt. (afterwards Lieut.-Colonel) George F. Macleod, C.B., R.E., died in 1851.

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"On the whole, I feel Lieut. Reid's merits and services to have been so conspicuous, that I venture, Sir, to recommend him to your consideration for the brevet rank of Captain in the Army.

"I have, etc.,

"RD. FLETCHER,

"*Lt.-Col., Commanding Royal Engineer.*

"LIEUT.-GENERAL MANN."

This recommendation was submitted to the Master-General of the Ordnance, but he refused to entertain it as there was no precedent. Reid's uncle, Major-General William Fyers, before this decision was given wrote the following letter to Reid :—

Letter from Major-General William Fyers, Commanding Royal Engineer in Ireland, to Lieut. William Reid, R.E.

"DUBLIN, 30*th March*, 1812.

"MY DEAR WILLIAM,

"I am afraid from my long silence you will think I have quite forgotten you. You know that I am not eminent for punctuality as a correspondent, and I really am quite ashamed when I think of the number of interesting letters I have received from you, unacknowledged by me. I have however not been so unmindful of you as you may suppose, having written twice about you to Lord Mulgrave, and sent to him two letters highly in your praise, which I received from your and my two good friends, Colonel Fletcher and Major Jones. Should I not be able to write to them before this packet goes, pray remember me in the kindest manner to them both. I have behaved almost as ill to my friend Jones, in the epistolary way, as I have to you.

"I received a letter the other day from General Mann. It was dated the 17th inst. and contained the following passage:—'Your nephew, Lieut. Reid, has come under notice; a difficulty arose about precedents, but some have been rummaged out of the War Office of the brevet rank of Captain being given, which I have produced, but I cannot yet say whether anything will be done.' Indeed, my dear William, I think they treat you with more coldness than they ought. But you must not let that discourage you; 'Persevere unto the end and you shall reap if you faint not.' That is, I think, as well as I can recollect, somewhere in the Bible.

"I suppose before the moment I am now writing Badajos has fallen. I cannot help thinking that you ought to have made it yours when last attacked. Perhaps I undervalue it too much. At any rate I hope you will not attempt a premature assault, and I trust you will escape without another touch.

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"Your friend Edward goes on very well . . . and, thank God, enjoys most perfect health of body and mind. The two girls are also in high health and spirits; they have a great deal of dancing and visiting. Edward also has an abundance of festivity, and is in great request at the balls. I propose that we shall set out on some travels in about a week; but I do not expect that my first trip will be for more than 8 or 10 days.

"*9th April*, 1812.

"I have been prevented by various circumstances from setting off on my journey, and in the meantime have to thank you for your letter of the 20th, and for one to Edward of the 18th. Your letters are really interesting and are read with some attention by some of the higher powers here. I am really much concerned about your wound, and am persuaded you all along made too light of it. You must, however, not be discouraged, and I trust that before this reaches you, you are a whole man, and on your legs again. I long to be told so by you.

"Edward and my daughters are all well and beg kind remembrances to you.

"I remain, my dear William,

"Your ever affectionate uncle,

"WM. FYERS."

On the 16th March, 1812, the third Siege of Badajos was begun. The city was invested by Marshal Beresford and 12,000 men on its south side without opposition. It was decided to attack the bastion of La Trinidad at the south-east corner of the enceinte by breaching it from a distance; for this purpose it was necessary, first, to take the outwork Picurina to the south-east of the enceinte, and separated from it by the inundation.

The officers of Royal Engineers employed were:—Lieut.-Colonel Fletcher, commanding, Majors Squire and Burgoyne (directors of attack), M'Leod, and John Jones, 6 captains and 13 subalterns. Of these 24 officers, 3 were killed, 1 mortally wounded and 9 wounded. Reid was sufficiently recovered from his wound to do duty in the trenches, though it still gave him trouble. Ground was broken on the 17th March in front of Picurina. On the 23rd Fort Christoval was invested. On the 25th fire was opened on Picurina, the lunette of San Roque, and the bastions of La Trinidad and San Pedro, and at night Picurina was assaulted, Lieuts. Stanway and Gipps each leading a column of attack. The assault was brilliantly successful and a lodgment was formed. The siege then continued steadily, until the breaches were considered practicable, and the time for the great assault arrived. It is not very clear what part Reid took in that assault, but he was certainly at San Roque under Major Squire.

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The writer's father, then Lieut. J. Vetch, R.E., had arrived from Cadiz at Badajos in charge of a detachment of Sappers on the 5th April to take part in the operations. He was accompanied by three other subalterns, Lieuts. Wells, Harry Jones, and Pitts. They found themselves only just in time for the final act, which was to have taken place that night. They were all in the trenches and Reid was with them when the assault was postponed until the following night. On the night of the 6th April Vetch, with a party of 200 men, was directed to attack the rear of the lunette of San Roque. It would seem that Pitts and Reid were with the party which attacked the faces and was directed to form a lodgment in it. Vetch had with him a junior subaltern, who has already been mentioned, Lieut. Wright, who had been wounded on the 20th March. As Reid probably shared Vetch's experiences on that famous night it may be interesting to quote the account which Vetch wrote of them at the time :—

"I was in the trenches from 4 o'clock in the afternoon until 10 p.m. on the evening of the 5th, and lost during the first half hour seven men of my small working party.

"The dispositions for the attack (on the 6th April) were as follows :—General Picton with the 3rd Division to escalade the castle, and the 4th and Light Divisions to attack the breaches, the 5th Division to escalade the works of the town on the left, a detachment to storm Pardilleros, and another of 200 men the ravelin of San Roque. The attempt on the castle was to be first, and to take place at 10 p.m.; the firing in that quarter was to be the signal for the rest. I was ordered with Lieut. Wright, R.E., to lead the party of 200 men at the ravelin of San Roque, where a lodgment was to be made. This ravelin is situated between the breaches and the castle, and I had therefore an excellent situation to observe what happened at both.

"A brisk fire opened from the castle at 10 p.m., and the enemy threw light-balls which gave them a great advantage. The firing at the castle had lasted about half an hour before that at the breaches commenced. That moment produced such a tremendous scene as can be better imagined than described. The night was dark. The castle was high on the right, the breaches low on the left. About 20,000 men were engaged in a small space, and the firing was kept up as quickly as possible, so that the whole scene seemed like a sheet of fire, a well-pitched light-ball now and then throwing a more steady light, and bringing the whole effect more fully to view.

"At the breaches the springing of mines, the bursting of large shells and barrels of powder, which the enemy rolled into the ditch from time to time, illumined the scene as brightly as daylight, but the light was so momentary that the objects were no sooner discerned than they were lost again in darkness. Some of our heavy batteries began to play, and the roar of the guns, the rattle of musketry, the explosion of shells and

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mines, combined with the vivid light and the alternate darkness, produced an effect which will not easily be effaced from the memory of those who beheld it.

"But this scene lasted so long without any appearance of victory that our hearts bled to think of the number of our brave fellows who were momentarily falling at the points of attack. At last about 1 a.m. the glad sound of the bugle was heard from the castle, the signal of victory. The parties at the breaches were repeatedly repulsed. The 5th Division, on the left, succeeded about 2 a.m. after great slaughter. Fort Pardaleros was carried in gallant style by the Portuguese Light Infantry. My party of 200 men carried the ravelin of San Roque in a moment, Lieut. Wright, R.E., gallantly leading, and our prisoners were marched through the breaches.[o] We discovered the enemy had left a gate open near the ravelin, which three of our companies took possession of. I was in the town by 3 a.m., before daylight, but was sent out to give notice of the gate being in our possession, and did not get back until 5 a.m. in broad daylight to behold the most shocking scene of dead and wounded, and the soldiers pillaging the houses. We lost 4,000 men in killed and wounded in the storm, and another 1,000 in the siege; the French 1,000 in the siege and storm. Among our casualties were 230 officers; of Royal Engineer officers alone 4 killed and 10 wounded, besides Assistant Engineers. The prisoners amounted to 4,000. The pillage lasted two days and the town was completely gutted. Two gallows were then erected to show that it was over, and the punishment that awaited any who disobeyed. Not many of the inhabitants were killed during the pillage, but they were left with scarcely a rag to cover them or a morsel to eat; broken chairs and tables only remained. When looking about for quarters I was requested most earnestly by a lady to take my quarters in her house by way of protection, which I did, and remained there two days. She turned out to be the Marquesa Z., an acquaintance of Lord Wellington, and he called twice upon her ladyship while I was there. The poor lady had scarcely a gown to cover her back."

On the 27th April, 1812, Brevet Majors Squire, Burgoyne and J. T. Jones were promoted to be Brevet Lieut.-Colonels and we find Lieut. Pitts writing shortly after the news had arrived:—

"We hear there are such people as *Lieut.-Colonels* Squire, Burgoyne, and Jones! I am likewise in hopes we shall soon see Lieut. Reid

[o] Sir John Jones, in his *Sieges in Spain*, says: "The assault commenced at the appointed moment by the party allotted to escalade the lunette, St. Roque, moving into the rear of that work, whilst the guard in the sap opened a musketry fire on its faces. This front fire so completely occupied the attention of the garrison of the lunette, that the escalading party fixed the ladders and mounted the rear enclosure wall almost unopposed, and actually came into contact with those defending the faces before they were aware of the work being carried."

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promoted to the rank of Captain in the Army; and if we can but get a precedent for a 2nd captain being made a major, the Corps will then be made. I think it a great shame if they make any scruple to promoting the 2nd captains, and as to Reid's promotion I fancy it is almost settled. He is an uncommon fine fellow, zealous to the highest degree, and *devoted* to the Service. With their promotion to look up to, and a good corps of Sappers and Miners (until we get which, we want our best half), we'll knock the dust in Johnny's eyes in a way that will make them wink. Burgoyne is a famous fellow, a captain and lieut.-colonel at 29. . . ."

But "want of precedent" stood in Reid's way. And yet, although no promotion, nor any other acknowledgment of his services came from home, his heart must have been even more greatly warmed by the generous, disinterested, and constant recognition of his merits by his brother subalterns, than by the commendations unreservedly bestowed upon him by the seniors under whom he served.

(*To be continued*).

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MEMOIR.

COLONEL C. R. CONDER, R.E., LL.D.

CLAUDE REIGNIER CONDER, who was the son of the late F. R. Conder, Esq., M.I.C.E., was born at Cheltenham on December 29th, 1848. He was educated at University College, London, and, after passing through the Royal Military Academy, Woolwich, was commissioned as Lieutenant in the Royal Engineers on January 8th, 1870. While under instruction at the School of Military Engineering, Chatham, he distinguished himself in surveying and showed great talent for drawing; these qualities and his knowledge of archæology attracted the attention of his superior officers; and, when, in 1872, the services of an officer of Engineers was required by the Palestine Exploration Fund in order to carry out the survey of Western Palestine, in succession to Capt. Stewart, R.E., who had, unfortunately been invalided home to England, the choice fell on Lieut. Conder. He was a very young officer for so responsible a position, but the result most fully justified the decision of the Committee of the Society, who were guided by the advice of the late General Sir Charles Wilson, a good judge of men.

Conder had only just completed his course at Chatham, when he embarked for the East, and took charge of the survey party, which, at that time had reached Nablus in Samaria. Prior to his arrival, and after Capt. Stewart had been taken ill, the survey work had been carried on by Sergts. Black and Armstrong, R.E., of the Ordnance Survey, under the superintendence of the late Mr. C. F. Tyrwhitt Drake, whose knowledge of the country and people supplemented the topographical skill of the non-commissioned officers.

The survey was commenced by the measurement of a base line, about 4 miles in length, near Ramleh on the road from Jaffa to Jerusalem, and from this a network of triangles was extended northwards for 65 miles to the plain of Esdraelon, where a second base was measured. The length of the latter was also calculated from the Ramleh base, and the result proved the accuracy with which the triangulation had been carried out. The triangulation was then carried gradually over the whole country, the points of observation being fixed by cairns, which afterwards served as a basis for the topographical survey. Every village and ruin was carefully marked, and its name noted.

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Besides carrying out the trigonometrical survey Conder did a great deal of valuable exploration in Jerusalem and other important places, and in studying the history of the country, as based on the geography.

The work went on steadily for three years by which time the survey of the greater part of the country west of the Jordan had been completed. In addition to the actual mapping, an enormous mass of information with regard to the topography and archæology of the country was collected, and a large number of places mentioned in the Bible, previously unknown, were identified. In June, 1874, Mr. Tyrwhitt Drake died of fever at Jerusalem, and his place on the survey party was filled by Lieut. Kitchener, R.E., now Viscount Kitchener of Khartum. In July, 1875, Lieut. Conder and his assistants were approaching the north of Palestine, and looking forward to the close of their labours, when a murderous attack was made upon them by the inhabitants of Safed, a town situated in the hills north-west of the Sea of Galilee.

Conder and Kitchener, with others of the party, were seriously injured, and it was decided to suspend the work for a time. With the assistance of the British Consul-General the assailants were duly punished by the Turkish authorities, and, after this had been satisfactorily arranged, Conder returned to England, and the plotting of the maps, and preparation of the Memoirs were taken in hand, a work which occupied nearly three years. In 1877, Lieut. Kitchener went back to Palestine and completed that portion of the map which had been left unfinished at the time of the Safed attack.

After the map had been completed on the scale of 1" to the mile, arrangements were made with the Director-General of the Ordnance Survey for printing it, while the Memoirs, containing all the valuable information collected by the survey officers, were published by the Palestine Exploration Fund. The results of Conder's work on the survey of Western Palestine were well summed up by the late Sir Walter Besant in the following words :—" It may be fairly claimed for the survey of Western Palestine that *nothing has ever been done for the illustration and right understanding of the historical portions of the Old and New Testament, since the translation into the vulgar tongue, which can be compared with this great work.* The officer whose name is especially associated with these maps and Memoirs has made himself a name which will last as long as there are found men and women to read and study the Sacred Books."

Lieut. Conder completed his work on the survey and Memoirs in April, 1878, and, besides receiving the thanks of the Committee of the Society for his services, was commended by the Secretary of State for War for the manner in which he had fulfilled his duties. This terminated his connection with the Palestine Exploration Fund for a time, and, in May, he was ordered to Edinburgh for duty in connection with the defences of the Firth of Forth. In the year previous he had married

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Myra, daughter of Lieut.-General Edward A. Foord, Royal (Madras) Engineers.

He was stationed in Scotland for three years, building new batteries on the Forth, and, in his leisure hours, continued his studies in the history and archæology of the Holy Land and adjacent countries. In 1878 he published his first book, entitled *Tent Work in Palestine*, illustrated with his own drawings. This gave a popular account of the survey operations and contained much interesting information respecting the manners and customs of the inhabitants of Palestine, the various Bible sites, and the topography of the city of Jerusalem.

In the following year Conder brought out two books, one, the *Handbook to the Bible*, and the second, *Judas Maccabæus and the Jewish War of Independence*, the latter giving the history of the Jews from the fall of the Kingdom of Judah to the successful termination of the revolt of the Maccabees against King Antiochus Epiphanus. These works were very popular and have gone through several editions.

In 1881 Lieut. Conder was asked by the Committee of the Palestine Exploration Fund to undertake the survey of the country east of the river Jordan, and, on this occasion, was accompanied by Lieut. Mantell, R.E., and Sergts. Black and Armstrong, R.E., the same non-commissioned officers who had done such good work on the western survey. The party landed at Beyrout in March, and, in the first place, made an expedition to the Lake of Homs in the valley of the Orontes, near to which Conder discovered the remains of the ancient city of Kadesh; then going south they crossed the Jordan, and commenced the survey by measuring a base between Heshbon and Medeba. A number of the trigonometrical points west of the Jordan which had been fixed when the original survey was made, were also observed and proved of great use as a basis for the new survey. This part of the country was full of interest, and it contained many ancient remains which were but little known. There was one point to which Conder devoted special attention; this was the description of the rude prehistoric stone monuments, which abounded in the district east of Jordan; the stone circles, cromlechs, and menhirs, etc., relics of the inhabitants of a bygone age. These were carefully planned, and photographed.

The work was proceeding satisfactorily, when peremptory orders were given for it to cease by the Turkish governor of Es Salt, who declined to recognize the old permit as giving authority for making a survey *east* of Jordan. Conder succeeded in completing about 500 square miles, and was then obliged to withdraw his party to Jerusalem; he had succeeded, however, in collecting a great deal of important information which was published with the map a few years later.

On his return to Jerusalem in March, 1882, Conder was requested

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to accompany Their Royal Highnesses Princes Albert Victor and George of Wales upon the tour which they were making through the Holy Land, under the guidance of the Rev. Canon Dalton. On their arrival in Jerusalem the Royal party proceeded to Hebron where the Sacred Haram, which as a rule is wholly forbidden to Christians, was, by command of the Sultan, opened for inspection. They then travelled north through the country by way of Samaria, Nazareth, and the Sea of Galilee to Damascus, and thence by Baalbec to Beyrout. Capt. Conder (he had been promoted Captain in January, 1882) wrote two interesting reports, one on the Haram at Hebron, and the second on the Palestine tour, for the information of the Prince of Wales (His Majesty the King) and these by order of His Royal Highness, were forwarded to the Committee of the Palestine Exploration Fund, and were published in the Quarterly Statement for October, 1882.

Soon after returning to England, Conder was selected for employment on the Staff of the Intelligence Department with the force which was sent to Egypt under Sir Garnet Wolseley to suppress the rebellion of Arabi. Here his knowledge of Arabic and of eastern people proved of great advantage for intelligence work. He landed at Ismailyeh in August, was present at the Battle of Kassassin and Tel-el-Kebir, and in the advance to Zagazig on September 14th. Soon after reaching Cairo, he was unfortunately taken seriously ill with typhoid fever, and was invalided home. After being on the sick list for some months he returned to work with the Palestine Exploration Fund and completed the map and Memoirs of the survey of Eastern Palestine.

Conder's next station was Chatham, but he had only been there a year when he was chosen for service under General Sir Charles Warren in South Africa and took part in the Bechuanaland expedition against the Boers. He was graded as Deputy-Assistant Adjutant and Quartermaster-General, and did good work in the Intelligence Department and in the survey of Bechuanaland. He was also British Commissioner on the Transvaal border, and was highly commended by Sir C. Warren for his services.

On the conclusion of the expedition Conder returned to Chatham where he remained for two years in command of a company. During his time at Chatham he published four books :—*Heth and Moab*, a popular account of his second expedition to Palestine, and descriptive of the districts east of the Jordan; a *Primer of Bible Geography*, specially intended for the use of students; *Syrian Stone Lore*, giving an interesting account of the ancient stone monuments of the country and of the buildings from the times of the Canaanites to the Crusaders; and *Altaic Hieroglyphs*, in which he dealt with the decyphering of the puzzling Hittite characters in the inscriptions found at Hamath, Carchemish and other places in Asia Minor.

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In July, 1887, Capt. Conder joined the Ordnance Survey at Southampton, and remained on the Survey for seven years. He was promoted Major in July, 1888. He did excellent work on the Survey, of which the late General Sir C. Wilson was at that time Director-General, and received the thanks of the Office of Works for improvements which he introduced as regards double printing on copper plates. Conder gave much assistance to Sir C. Wilson with regard to the publications of the Palestine Pilgrims' Texts Society, of which the latter was the Director.

In 1891 Conder published a work entitled *Palestine*, giving a useful *résumé* of what was known of the history and geography of the country, and, in 1893, he wrote *The Tel Amarna Tablets*, being a translation and description of the letters in cuneiform character, written about 1480 B.C. from Palestine and Syria to the then King of Egypt, letters which throw a flood of light on the connection between the countries, and which were of special interest to Conder in his studies with regard to the history of Palestine.

After the conclusion of his term of service on the Ordnance Survey, Major Conder was sent to Ireland for employment on the fortifications of Berehaven. He was also employed on the Irish relief works in 1895, and received the thanks of the Government for the services he rendered in connection with the latter. In August, 1895, he was promoted Lieutenant-Colonel and was appointed Commanding Royal Engineer at Weymouth where he remained five years. At this station he had much to do in connection with the fortifications of Portland, the submarine mining defences and the installation of searchlights. The books which he published during this period of his service were the following:—*The Bible and the East; The Latin Kingdom of Jerusalem*, which gives an account of the history of Palestine from the first crusade to the final expulsion of the Christians in 1289; *The Hittites and their Language;* and *The Jewish Tragedy*. He was promoted Brevet Colonel in 1900, and was again employed on the Ordnance Survey until 1904. He retired from the Service on November 2nd, 1904.

After leaving Weymouth he published the following works:—*The First Bible*, in 1902; *Critics and the Law*, 1907; *The Rise of Man*, 1908; and *The City of Jerusalem*, 1909. The latter book gave an account of all the recent results of exploration and research as regards Jerusalem, and traced the history of the sacred city for 4,000 years. Besides the separate publications which have been referred to, Colonel Conder contributed a very large number of valuable reports and papers to the quarterly statement of the Palestine Exploration Fund from 1872 up to January of the present year. He also wrote articles respecting Palestine for several of the encyclopædias, embodying the results of his researches.

It is impossible in a short article like the present, to give even a

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résumé of the contents of the many interesting books written by Colonel Conder, as they contain information on every possible subject connected with the history and geography of the Holy Land from the earliest times. To the student the Memoirs written in connection with the survey are perhaps the most valuable, on account of the details they give respecting every place in Palestine, arranged for the use of scientific readers.

Colonel Conder died at Cheltenham on February 16th, greatly regretted by his many friends. One cannot but feel that it was an honour to the Corps of Royal Engineers that his name is enrolled on the list of our officers.

It is a curious coincidence that Sergt. Armstrong, who was Conder's faithful assistant on the survey of Palestine, and who for many years had been the acting secretary of the Palestine Exploration Fund, died on January 7th, only a few weeks before his former chief.

C. M. WATSON.

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TRANSCRIPT.

WIRELESS TELEPHONY.

(Adapted from the *Bulletin of the International Railway Congress* by 2nd Lieut. A. H. SCOTT, R.E.).

(1). INTRODUCTION.

THE term "wireless telephony" is generally taken to imply the method of transmitting speech by means of electric waves. The first wireless telephones transmitted speech by means of light waves, but as these two methods present a certain number of analogies, and moreover, the fundamental principles of wireless telephony by means of electric waves are closely related to those of telephony by means of light waves, it is interesting to glance at both methods. Graham Bell's photophone, invented in 1880, was the first attempt at light-wave telephony, and made use of the singular properties of selenium. It made telephonic communication possible over a distance of about 220 yards.

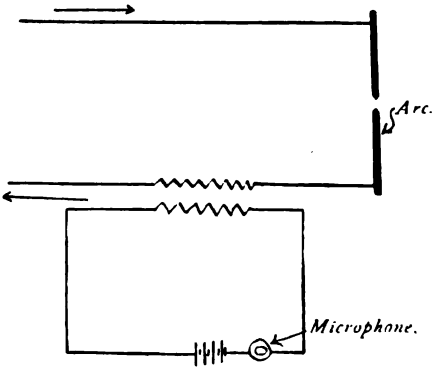

FIG. 1.—*Simon's Singing Arc.*

Ruhmer improved upon this, and succeeded in transmitting speech over a distance of about 9 miles. For his purpose, he made use of the properties of Simon's singing arc (*Fig.* 1). This device consists in superposing on the continuous feed current of an arc, the current induced in

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the secondary windings of a transformer by a microphone circuit connected with the primary. The microphonic transformer can also be arranged on a branch at the terminals of the arc, by inserting a small auxiliary condenser. The arc faithfully reproduces any sounds produced in front of the microphone and acts like an excellent telephone receiver. This phenomenon is due to the fact that it responds to the smallest variations in the wave current in its circuit. These variations, which give rise to the sounds, are represented by corresponding variations in the temperature of the arc and involve variations in the brilliancy of the light. The arc thus acts, not only as a telephone receiver, but also as a photophonic transmitter. It is merely necessary to place it in the focus of the mirror of a searchlight, and to direct the pencil of rays on to a similar one, having at its focus a selenium cell arranged in the circuit of a telephone, in order to obtain a reproduction of the words at the receiving station. This property of the arc is most important, as it forms the basis of a large number of devices which are used for telephonic transmissions by electric waves.

In the case of electric-wave telephony, the transmitter includes a microphone circuit, together with a source of emission, which generally consists of an oscillation circuit similar to those used in wireless (electric-wave) telegraphy, in connection with a tuned radiation system. Considering the transmission antennæ as a source of emission of the electric waves, which travel through intervening space in the same way as the light waves, it may be conceived that it is possible, just as in the case of light-wave telephony, to proceed in two different ways in order to make the sound affect the emission of the electric waves. These ways are:—(1). By modifying, by means of the microphone circuit, the intensity of the oscillations, their period remaining unchanged. (2). By keeping the intensity constant, and modifying the mutual reactions of the connected systems by the microphone circuit. This involves variations in the syntony of the apparatus. This plan can be very effective.

If conditions are arranged so as to be most favourable to selective effects, that is to say, if feeble damping is used, very slight alterations in the condition of resonance result in considerable modifications in the intensity of the effect received. Electric oscillations have a period which is not of the same order of magnitude as that of sound waves, and thus the sound waves cannot be made to act directly on the oscillations themselves. The electric oscillations succeeding one another with a certain rhythm give rise to wave trains; it is this rhythm which is capable of modifying the sound waves. In principle, the transmission is always affected by the undulations in the whole wave trains.

In constant-period transmission, this undulation results necessarily and directly from the variation in intensity of the waves sent out, *i.e.* from the variations in the intensity of the source. In constant-intensity transmission, it results from the variation in the number of wave-trains acting on the receiver.

Although the number of wave-trains sent on may be invariable, these trains may act in a different way on the receiver, if they correspond to differently tuned waves.

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(2). The Relation between Wireless Telegraphy and Wireless Telephony.

As soon as wireless telegraphy began, attempts were made to utilize its apparatus for transmitting speech. As long as only a coherer was available, *i.e.* a wave detector incapable of registering continual variations in the intensity, it was evident that there was no hope of obtaining any result. When auto-decohering detectors became available, attempts were first made to act on the spark itself by means of a microphone circuit. Later an attempt was made to obtain variations in the length of the spark by the rhythm of sound waves, by connecting one of the electrodes with a vibrating membrane, mechanically actuated by the microphone. All these devices were successively proposed and abandoned, the one definite obstacle to their application for the transmission of speech being the use of discontinuous and damped discharges for producing electric waves in the sending antenna.

In wireless telegraphy, whatever the device used, the discharges are obtained by connecting the balls of the oscillator with the secondary of an induction coil, or of a transformer excited by low frequency alternating current. The successive wave-trains are then always damped, and as a rule very far apart. This renders the use of devices on this system totally unsuitable for the purposes of telephonic communication.

It is not on each individual wave-train, that the sound vibrations act, but on the trains as a whole. In order therefore that these modifications may convey differences of sound, it is above all necessary that they affect a sufficient number of trains.

To take a definite case, let it be assumed that it is required to transmit the standard note A, which has 435 vibrations per second. The series of trains sent out in a second must have 435 perturbations or beats, and this will evidently be only the case, if the number of trains sent out exceeds 1,000. Now, in the ordinary processes of emission by sparks, the number of trains sent out hardly exceeds 100 per second, and is often less. The phases of activity are thus interrupted by long intervals of rest.

Consider the emission of a wave of wave-length of 330 yards, which corresponds to oscillations with a period of one millionth of a second. Each train consists of about 20 oscillations, and therefore covers $\frac{1}{50000}$ second. Assuming there are 100 per second, it is only after an interval that is 500 times longer, that a new train will succeed it. If one train in *Fig.* 2 be represented by a length of 1 centimetre, the distance between two successive trains will be represented by a length of 5 metres. Notes of much higher pitch than the one chosen are often used, so it is at once

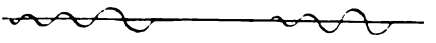

Fig. 2.—*Wave-trains.*

evident, that, no matter how ingenious the arrangement of the microphone circuit, the method of excitation by sparks is hardly suitable for wireless telephony. The only way of obtaining any result is to modify the system of emission so as to increase the number of wave-trains. This has been done by the use of Duddell's arc, by means of which it is easy to obtain 20,000 and even 30,000 vibrations per second, *i.e.* to attain the limit of audible sound.

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(3). DUDDELL'S ARC.

Fig. 3 shows the practical adaptation of this method, which is a development of the well-known phenomenon of the singing arc; the explanation is as follows:—While the sound is produced by the singing arc, an alternating current is being produced in the condenser circuit. This current has the same frequency as the sound waves, and exercises an energetic inductive action on neighbouring circuits. The primary of a transformer is fed by this current, which has a frequency that is already considerable in comparison with the alternating frequencies generally used, and discharges are obtained in the circuit of the secondary of the transformer, which succeed each other with the same rhythm, (that of the

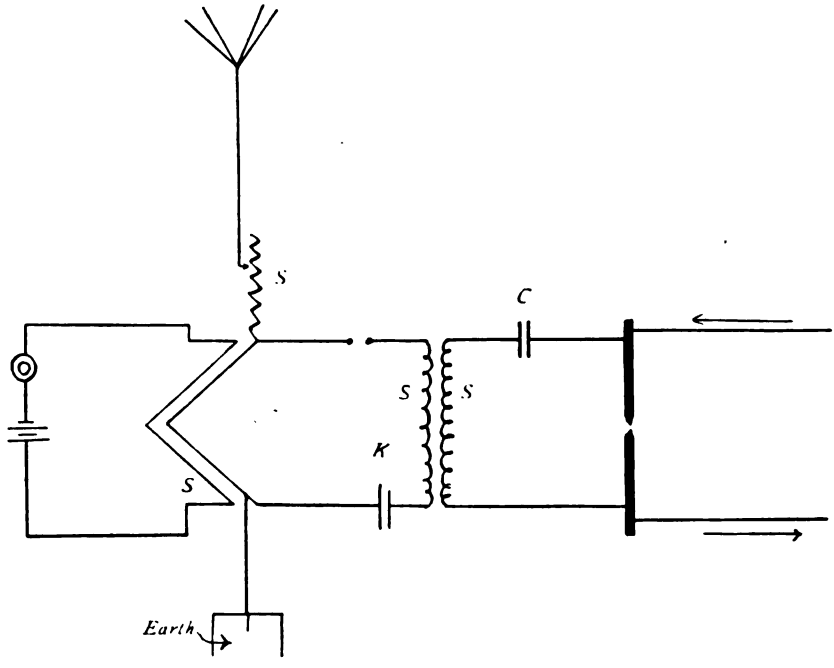

FIG. 3.—*Utilization of Duddell's Arc.*

sound). In order to utilize this phenomenon, a condenser C and a self-induction S, which forms the primary of a transformer (without iron), whose secondary feeds the discharge circuit connected with the antennæ, are arranged on a branch from the arc A. The secondary circuit includes a condenser K, and the primary turns of a tuned resonator on the antenna. The capacity of the condenser K is determined by the condition, that it must be in tune with the secondary of the transformer S. The primary of S has only a few turns of wire and the condenser C is designed so that the note given by the arc is extremely shrill. The sound wave acts by means of a small coil with two windings, the primary forming part of a microphone circuit. The receiving circuit is the ordinary receiving circuit used in wireless telegraphy by sound.

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(4). Poulsen's Method.

By means of Poulsen's method it is possible to multiply the number of trains sent out, and diminish the amount of blank space between the successive trains, till finally, instead of a discontinuous succession of damped discharges as are obtained in the case of sparking, a single and continuous wave-train is obtained. Poulsen has succeeded in increasing the rate of vibration of the singing arc from 30,000 to over 500,000 per second.

The principle of his method is to produce the arc in an atmosphere of hydrogen or of coal gas, and the phenomenon is the more readily produced if the cooling action of the hydrogen is assisted by an electric blow-out, *i.e.* by placing the arc between the poles of an electro-magnet. The arc should be fed with a high tension current of at least 400 to 500 volts. The arc must also have a certain "effective" length which increases with the current, and decreases with the frequency. The cooling of the electrodes is effected by placing them in hollow tubes, through which cold water is circulated. The best results are obtained if dissimilar electrodes are used, the anode consisting of a hollow copper tube having at its end a concave hemispherical wall (*Fig.* 4).

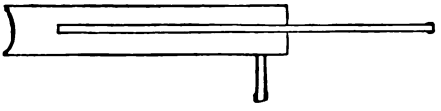

Fig. 4.—*Metal Electrode, Water Cooled.*

The effect of cooling the electrodes, and of the magnetic blow-out, is to make it possible to materially increase the intensity of the current in the arc, without stopping it from acting.

With the Duddell arc, the capacity of the condenser on the branch can scarcely fall below 1 microfarad; in this case, it can be given a much lower value. The production of the vibrations does not make a sound, the number of vibrations being far beyond the limit of audible sounds, but it can be made evident by the intense inductive action on neighbouring circuits.

Figs. 5 and 6 show the principle of this method. The oscillation circuit should be arranged to contain a condenser and a self-induction. It should be arranged on a branch from the electrodes, and be connected

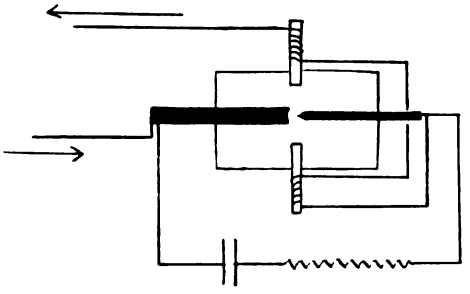

Fig. 5.—*Poulsen's Arc.*

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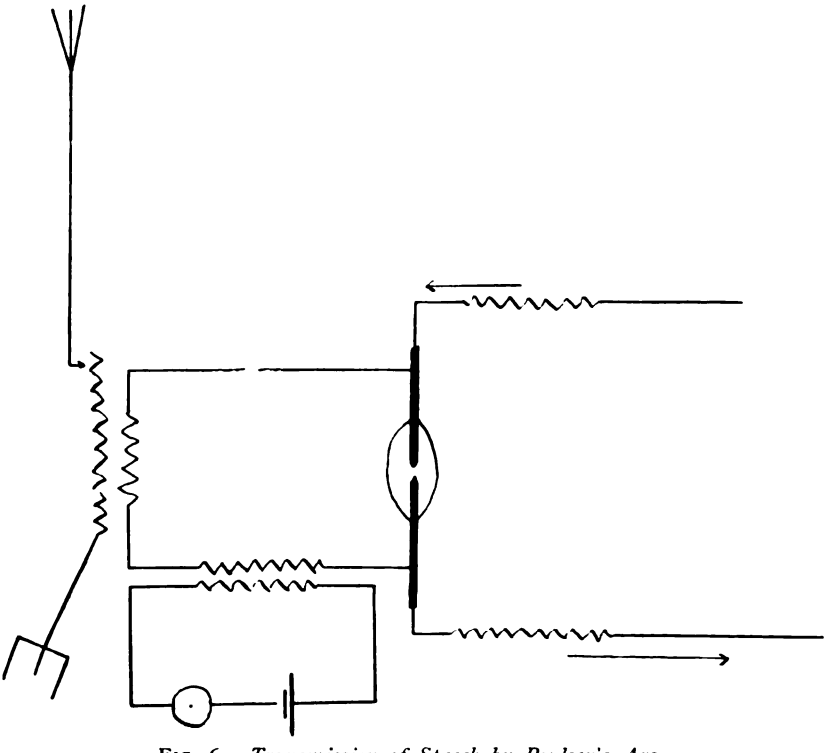

FIG. 6.—*Transmission of Speech by Poulsen's Arc.*

to the antenna, either through some turns which form the primary of a Tesla, or by means of an Oudin resonator. It must be tuned to the antenna. The sound waves act by means of a microphone circuit, on a coil whose primary forms part of the feed circuit.

The receiving end consists of any suitable automatic decoherer, (generally electrolytic) which is on a tuned circuit on the receiving antenna, as in the case of wireless telegraphy (*Fig.* 7).

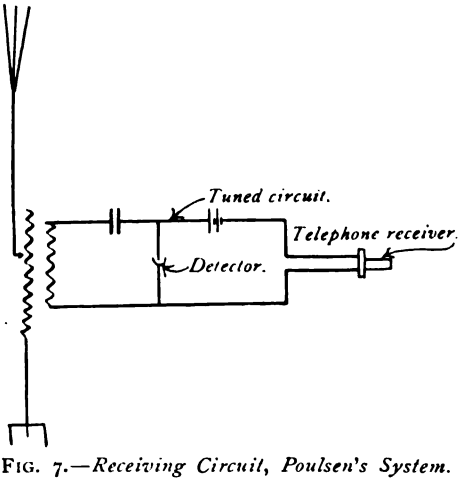

FIG. 7.—*Receiving Circuit, Poulsen's System.*

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(5). De Forest System.

In De Forest's system, the source of emission is a Poulsen arc, which instead of burning in hydrogen, burns in the gases produced by the burning of a spirit lamp. The other difference, is that the microphone is placed at the bottom of the antenna, directly in series; this greatly improves the conditions of emission.

The receiving circuit is shown in *Fig.* 8. Its main peculiarity is the audion (*Fig.* 9). This is an ionized gas detector, invented by De Forest, and

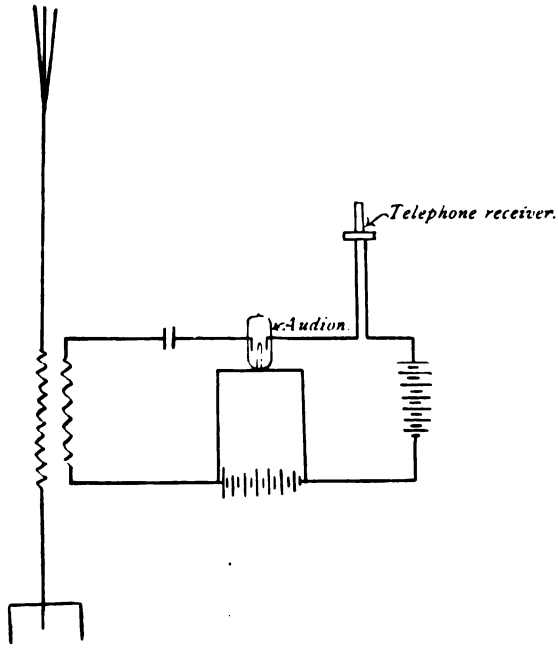

Fig. 8.—*Receiving Circuit, De Forest's System.*

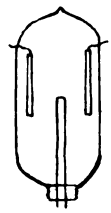

Fig. 9.—*De Forest's Audion.*

based on the Edison effect. Edison discovered as far back as 1881, that if an extra auxiliary electrode is placed on the wall of an incandescent lamp, there is a current in a circuit connecting that electrode with one of the terminals of the lamp, preferably the negative terminal. This phenomenon has been explained by the projection of a flow of negative particles escaping from the incandescent filament. This enables the

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audion to act as a valve, when it receives alternating oscillations, and thus it allows only the discharges of one sign to pass.

The trials of the De Forest instrument were so good, that the U.S.A. Government ordered it to be installed on all the vessels of Admiral Evans' fleet.

(6). THE REMAINING DIFFICULTIES.

The principal difficulties in a wireless telephony system using an arc arise from the irregularity of the source itself. The arc produces a discontinuous succession of undamped wave trains, rather than a single wave train. Moreover, as a rule, not only is a single oscillation of one period produced, but a mixture of oscillations of different periods. The problem would be solved if instead of using an arc to produce the oscillations, some purely mechanical means were available, *i.e.* an alternator of high frequency. Many attempts have been made to produce these. Tesla and Elihu Thomson have constructed alternators giving a frequency of 10,000 to 15,000 periods. These machines consist in principle of a slotted disc, with a large number of slots, revolving inside a ring of field poles. Centrifugal force makes it impossible however for these discs to revolve at over 10,000 revolutions per minute.

Duddell and Ruhmer have recently invented machines consisting of small discs from which they were able to obtain frequencies of 120,000 and 300,000 respectively, but unfortunately, these high frequency alternators only give a very low power (Duddell, 0·2 watt; Ruhmer, 0·001 watt).

Fessenden has an alternator, which, running at 139 revolutions per second, gives a frequency of 50,000 periods, and the power of which is 40 watts.

(7). PRESENT POSITION OF WIRELESS TELEPHONY.

Wireless telephony can now be said to have passed the laboratory stage and to have entered the domain of industrial application. The Poulsen arc system is much used. Poulsen has succeeded in obtaining telephonic communication over a distance of 105 miles; and the same distances have been obtained by officers of the French Navy in the course of experiments (Paris to Melun).

The record is at present held by the Italian Navy, as last November (1908) the torpedo boat *Lanciero* succeeded in exchanging messages firstly between Rome and Gaeta, (120 miles) and then between Rome and Caprera, a distance of 250 miles.

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NOTICE OF MAGAZINE.

KRIEGSTECHNISCHE ZEITSCHRIFT.

January and February, 1910.

HAND GRENADES.—The hand grenade so extensively used in the Russo-Japanese War is no new weapon. At the beginning of the 16th century one Baptista della Valli wrote a pamphlet on the manufacture and use of hand grenades. In the Netherlands in 1606 they were also frequently employed. In the course of the 17th century their employment became even more general.

These old hand grenades were usually hollow iron balls filled with powder and fired by a fuze. They were uncertain in action and to avoid accident as far as possible special men of considerable strength and coolness were selected to use this weapon.

Louis XIV. in 1667, ordered every company in the French Army to provide four such men who were called grenadiers and received a higher rate of pay. Later on they were formed into separate companies and battalions. This arrangement was followed in the English Army. Even cavalry regiments were equipped with this weapon and called horse grenadiers. Their services were chiefly employed during the storming of a fortress, when they rode at full speed up to the works of the defence, halted while they lit the fuze, threw the grenades into the work, and galloped back.

However as artillery improved and shell fired from guns came into use the value of hand grenades diminished and they are hardly mentioned in the accounts of the Napoleonic Wars. They are not heard of again until the Crimea, where they were used on both sides. The Russians in the absence of cast-iron grenades made use of bottles filled with powder, with the fuze coming out at the neck. They were also used in the American Civil War but after this sank into an oblivion from which they did not emerge until the desperate struggle about Port Arthur called them into being.

The Japanese, who adapt themselves so easily to circumstances, were the first to resort to them. The earliest patterns were simply tins filled with dynamite and provided with a piece of quick match, which projected from the tin and was lighted by the man just before he threw it. This was a very primitive affair which not only often failed but also occasionally provided the enemy with an extra weapon. The quick match owing to damp or other cause burnt too slow and the Russian soldier picked up the grenade and threw it back. Later on the Japanese adopted the "Martin Hale hand grenade" made by the Powder Company at Faversham.

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This resembles the one in use in the British Service and needs no detailed description.

To throw a hand grenade effectively requires considerable skill. After long practice a distance of 50 yards may be covered, but it is reported that in the Russo-Japanese War 50 per cent. of the men who used hand grenades were wounded at one time or another by their own grenade.

The Japanese also tried a rifle grenade made by the same company. The grenade itself is similar to the hand grenade but the handle is made to fit into the muzzle of a rifle, and is fired by an ordinary cartridge. The initial velocity is naturally very low averaging only 100 yards; but with an increased charge a range of 250 yards has been obtained. The low final velocity or velocity of impact is an advantage as it allows the explosion to take effect to the rear instead of entirely in a forward direction.

The effect of the rifle grenade is slightly less than that of the hand grenade but greater accuracy is obtained The flight of the grenade can be watched by the firer and his aim corrected for the next shot if necessary.

To shoot the grenade to any distance at all the rifle must be so elevated that the sights are useless. Thus to obtain accuracy considerable practice is necessary. The danger to the man firing is far less than to the man throwing a grenade. The highest rate of fire at present reached is three shots a minute, but the soldier cannot well carry more than four of these grenades so that a high rate of fire is hardly desirable.

The Russians and Japanese used hand grenades not only at the Siege of Port Arthur but also in field warfare, but the author of these articles considers that they should be confined to fortress warfare only. To throw a hand grenade or to fire a grenade from a rifle, a man must stand up. It would be suicidal to do this within 100 yards of the enemy's trenches unless the man is also under cover himself. Therefore for the attack at least they seem hardly worth carrying.

For the defence the use of grenades in field warfare is more favourable, because the man can throw or fire them from behind cover, and it is also possible for him to keep a greater number of grenades at hand under cover. Even then it seems probable that accurate rifle fire would have far greater effect against advancing troops than the uncertain and ill-aimed grenade.

Hand grenades will undoubtedly be useful to the storming columns in fortress warfare, as, if thrown amongst the defenders behind cover, they will do considerable damage and there will be no risk of splinters flying back and injuring the stormers themselves; moreover at these very close ranges they will be able to search out the defenders much better than rifle bullets can do.

The French have also introduced a hand grenade into their army. It consists of a hollow cast-iron shell 8·1 c.m. in diameter loaded with ·11 k.g. of powder. The fuze consists of a metal tube containing quick match and then a slow fuze burning five seconds, which is fired by a cap and striker, the latter ending in a loop which is normally sealed down with paper.

To use the grenade the seal is broken and the ear of the striker is placed over the hook of a leather strap fastened to the man's arm. The

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grenade is then thrown and the striker, pulled out by the arm strap and the fuze thus fired, and in five seconds the grenade explodes. With the French grenade also the man who throws it is liable to be injured by back splinters and men are forbidden to use it except from behind cover.

The range when thrown by hand is only some 20 to 25 yards, but if a sling is used 50 yards can be covered. Considerable skill appears essential for the successful use of these grenades and six practice patterns have been issued to every company and battery.

As in the time of the first grenades it appears likely that special men only will be able to use them with advantage, so that in the near future the term grenadiers is likely to have its old meaning restored to it.

The French pioneer battalions have also been ordered to practice themselves in the construction and throwing of improvised hand grenades.

Spain.—Spain has adopted the Martin Hale grenade and these were largely used at Melilla. The regiments recruited from mountainous districts are given the greatest practice because they are naturally skilful in the use of slings. Each grenadier carries four grenades.

The Lack of Proper Instruction and Training in Field Fortification.—In an article under this heading the author discusses the lessons of the Russo-Japanese War, in which field fortification was used to an unprecedented extent. The technical troops on each side, by universal opinion, deserve the highest praise for what they accomplished, and if in some cases field fortification was apparently a failure it cannot be laid entirely to their account.

In the Russian Army the commander of the sapper battalion allotted to an Army Corps becomes on mobilization the Corps Engineer. The fortification of positions in Manchuria however was taken out of the hands of the Corps Engineers and transferred to a number of young engineer officers working under the direction of General Wjelitschko on the Headquarter Staff. This may have been due to the desire to construct the elaborate defences of Liaoyang, etc., on harmonious lines, but it resulted in considerable friction and misunderstanding, as the commanders of sections had often quite different ideas on the subject to those of the engineers. Their disapproval communicated itself to the troops, and no one had confidence in the siting or design of the defences. It is hardly to be wondered at that in such circumstances the defences were sometimes lightly abandoned, and that spade work generally lost credit in the eyes of the troops, who resorted to it with very ill grace even when circumstances rendered a speedy provision of cover very essential. Another consequence was that entrenching tools were lost in very large numbers.

Undoubtedly the chief value of field fortification was considered to lie in the preparation of elaborate defences, the idea being to create in this way a very strong position which the enemy would run up against. This hope was doomed to disappointment. The Japanese contained the front and, by enveloping one of the flanks, compelled an immediate retirement, either after a short resistance or sometimes without any fighting at all. Hasty field defences as opposed to the elaborate defence of positions were

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practically neglected, because the Russians wished to wage a "war of positions."

On the occasions when hasty field defences were resorted to, they were seldom of great value because the ruling principle that field fortification is the handmaid of tactics was disregarded. In order that this truth may be universally acknowledged it is necessary for troops to be thoroughly trained in field fortification during peace. Liaoyang is a classical example of the failure of elaborate defences, owing to the fact that the troops were insufficiently trained in this branch of war and were unacquainted with the true *rôle* of fortification in field warfare.

The theatre of operations was generally mountainous, and in such country theory and practice are somewhat antagonistic. Theory requires that the trenches of the firing line should be pushed so far down the forward slope of a position that no dead ground exists. The disadvantage of this system in practice is that the troops occupying the trenches are more exposed, and covered communication to the rear is often impossible where the time available for the preparation of the position is limited.

When the Russian infantry had to entrench themselves they always—unless an engineer officer was at hand—sited their trenches near the crest. The field of fire was very limited, and there was a deep zone of dead ground, and then another field of fire—but at long ranges. This explains why in many cases the Japanese were able to get within 50 yards of the Russian trenches and lie down and open fire; it also explains why the Russians frequently expended all their ammunition while the Japanese were at distant ranges.

In striving to reconcile the conflicting demands of theory and practice the following conditions should be complied with:—

(*a*). The importance of strong works on those points of the position whence enfilade fire can be brought to bear on belts of dead ground must be recognized.

(*b*). The practice of distributing troops equally along the entire position must be abandoned.

(*c*). The defences must be most complete at the strong points of a position, and here the trenches should be traversed and recessed and provided with head and overhead cover.

(*d*). The work must be carried out without intermission by the employment of successive reliefs.

(*e*). At other points time will only admit of simple trenches and here concealment is of vital importance.

The faulty principles which prevailed in the employment of field fortification in Manchuria would have been avoided if the lessons of the campaign of 1877 and 1878 had been taken to heart.

That the experiences of this campaign were disregarded appears to have been due to Dragomiroff. It was due to him that the Russian infantry was taught to believe that success was best obtained by an impulsive advance, and that no time should be wasted in procuring superiority of fire. Spade work was abhorrent to Dragomiroff and the

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individual who entrenched himself was considered to be digging his own grave. Progress in field fortification was confined to the sappers, and they entirely neglected to work in co-operation with the infantry. They trained apart by themselves and wasted much time over unimportant details and unnecessary finish. During manœuvres the higher commanders had no notion how to employ their sappers, who were either used as infantry pure and simple, or else entirely ignored, and all opportunity of instructing infantry in the value of entrenchments was lost. In the theatre of war the consequences were soon apparent, and the following remarks of various officers on this subject are rather illuminating.

On one occasion "the men left all their tools behind at their last position." Again "the infantry look on their entrenching tools as an unnecessary burden and take the first opportunity to throw them away."

"The constant friction between the sappers and infantry arose entirely from the dislike the latter had for spade work."

"The works constructed by infantry under their own officers were not only useless, but a source of danger."

The utter indifference of the higher commanders for their technical troops is shown by the following remarks :—

"The corps retired by a different line, without the sappers being informed of the retreat at all."

"When several divisions were bivouacked together for the night no place was allotted to the sapper companies and no Corps or Divisional Orders were communicated to them."

Such a state of things is obviously fatal. Field fortification must be immediately in accord with the tactical requirements of the situation, and the infantry must be thoroughly trained in this branch of war. The sappers must not be kept uselessly in rear but must work with the infantry in the firing line when required; and the closest co-operation must exist between sappers and infantry both in attack and defence.

The condition of affairs in the Russian Army during the war is not without its lesson for us, and the following suggestions of the author for improving matters are also of interest. He recommends that sappers and infantry should spend some of their training together; and that on occasions task work should be discarded and the energies of the men be stimulated by competition.

When trenches are constructed on manœuvres, any company or regiment which has not finished them in the allotted time should be ruled out of action, and held to have disgraced itself.

The summer training of sappers should be divided into three periods :—

1st. On very technical training by themselves in demolitions, mining, etc.

2nd. All training in field fortification to be done in conjunction with infantry.

3rd. Manœuvres during which the sappers should work with the infantry and be always actively employed instead of being left with the Reserve or in camp.

C. Otley Place.

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RECENT PUBLICATIONS OF MILITARY INTEREST.

JANUARY, 1910.

(*Published Quarterly*).

THE following extracts from the list compiled by the General Staff, War Office, are published in the *R.E. Journal* by permission of the Army Council.

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PART II.

SECTION I.

AERIAL NAVIGATION.

THE CONQUEST OF THE AIR. By Alphonse Berget. 295 pp., with numerous photographs and diagrams. 8vo. London, 1909. Heinemann. 12s. 6d.

We owe Monsieur Berget a debt of thanks for having produced this translation of his French work. The extraordinary development which has taken place during the last eighteen months in the science and practice of aviation is hardly yet fully realized in England. The appearance of this book comes, therefore, at an opportune moment; and, while the author makes no claim for it to be a treatise on aeronautics, he describes clearly the bases of aerial navigation in its two actual forms.

Part I., which consists of 115 pages, deals with dirigible balloons and shows how the modern form has been evolved. At present a dirigible can hope to cope with the wind and steer in any direction on an average of 300 days in the year. To increase this number to some 350 days a considerable increase in horse-power, and consequently in weight, will be necessary; such, in the opinion of the author, must be the aim of future designers.

Part II. is devoted to aviation apparatus. The first three chapters explain the principles of aviation and their application in the construction of aeroplanes.

In subsequent chapters the essential differences between monoplanes and biplanes, as well as between the American and French schools of aviation, are clearly described.

The last chapter discusses the future of both forms of aerial navigation. The conclusion reached, so far as their military uses are concerned, is that their principal utility will be as scouts.

Anyone, however, who is interested in this subject should read the book for himself and make his own deductions as regards the future of aviation.

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WRIGHT AND ZEPPELIN (Wright und Zeppelin). By Rudolf Martin. 22 pp. 8vo. Berlin, 1909. Mickisch, Segler & Co. 3d.

The object of the author is to show that greater advantages must accrue to Germany from the inevitable progress in the science of aviation than to any other country. In fact this science has come as a saviour to the Fatherland. Germany is strong on land, he continues, but weak on the sea. In future, however, no one in Germany need be afraid of defeat in war by either land or sea.

Martin then proceeds to weigh the various merits of the heavier, and lighter, than air flying machines. If war were to break out in five years' time, hundreds of giant airships and thousands of aeroplanes, he asserts, would move into the field on the German side.

Finally, Martin affirms that the greatest change that progress in aviation has brought about is the fact that England is no longer an island. He then endeavours to show how month by month a German invasion of England becomes more feasible and how ill the British Navy would fare in a contest with the German airship fleet.

He sums up in conclusion by stating that Wright and Zeppelin are thus a guarantee of peace between England and Germany. Why this follows from what he has written is not explained.

FORTIFICATION AND MILITARY ENGINEERING.

TEXTBOOK OF FORTIFICATION, DEALING WITH ENGINEER AND TRANSMISSION SERVICES AND FORTRESS WARFARE, USED IN THE ROYAL WAR SCHOOLS (Leitfaden für den Unterricht in der Befestigungslehre im Pionierdienst, Verkehrswesen und im Festungskrieg auf den Königlichen Kriegsschulen). Official. 199 pp., with numerous diagrams and plans. 4to. Berlin, 1909. Mittler. 6s. 6d.

This very comprehensive manual is divided into five parts and six appendices.

Part I. deals with transmission services and includes railways, motor tractors, all means of transmitting information in the field, bridging, waterways and roads; Part II. with obstructions and demolitions, both in connection with roads, bridges, railways and telegraph lines and with navigable waterways; Part III. with camps and bivouacs; Part IV. with field and permanent fortification; and Part V. with the attack and defence of fortresses.

In the appendices useful tables are given, showing the number of entrenching tools carried by German units in the field, penetration of bullets and projectiles, carrying capacity of pontoons and pontoon bridges in the German Army, demolition stores carried in the field, etc.

THE COAST DEFENCES OF SEA POWERS OTHER THAN GERMANY (Die Küstenbefestigungen der ausserdeutschen Seemächte). By Capt. W. von Stavenhagen (retired). 88 pp., with seven plans. 8vo. Berlin, 1909. Mittler. 3s.

The author commences by giving a comparative statement of the strength of the navies of the Great Powers dealt with, in tabular form. He then discusses the coast defences of the Powers under (1) *Great Sea Powers*, in which he includes Great Britain, the United States of America, France, Japan, Italy, Austro-Hungary and Russia, and (2) *Small Sea Powers*, in which he includes Norway, Sweden, Denmark, Holland, Spain, Portugal and Turkey in Europe.

The seven plans show the naval bases of Portsmouth, Dover and Portland, the Thames and Medway Defences, Copenhagen (2) and the Bosphorus.

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THE STUDY OF FORTIFICATION (Le thème de fortification). By Capt. Lenoble. 64 pp. 8vo. Paris, 1909. Chapelot. 1s. 3d.

This short treatise is of interest to the engineer and to the infantryman alike, for it deals especially with such engineering work in the field as is likely to come within the cognizance of an infantry officer. The author holds that engineers, no less than cavalry and artillery, are auxiliaries of the infantry, and that the frequent use of such expressions as "the combined action of the *three* arms" has tended to keep the Sapper in the background, and has prevented the realization of the necessity for his action being in complete accord with tactical requirements. After discussing the utility of field fortifications under varying conditions, he goes closely into the question of how the labour involved in their construction is to be divided between the infantry and the engineers.

There are two short appendices. The first deals with the trace and siting of entrenchments, and the provision of head-cover; the second with calculations for working parties, demolitions and bridging.

HISTORICAL.

THE MILITARY HISTORY OF GERMANY IN THE 19TH CENTURY. PART I. (Kriegsgeschichte Deutschlands im Neunzehnten Jahrhundert, Part I.). By Colmar Freiherr v. d. Goltz. 516 pp. 8vo. Berlin, 1909. Bondi. 11s. 6d.

This volume deals with the Napoleonic era. The first chapter contains a review of the Prussian Army organization and tactical training from the days of Frederick IInd to the year 1806. The second chapter deals with the disasters of 1806 and 1807, concluding with the Treaty of Tilsit. The third chapter describes the measures taken to introduce reforms and to reconstruct the military system.

The fourth chapter, which is much the longest, embraces the whole period of the War of Liberation, including the campaign of Waterloo. The book contains numerous sketches illustrating the chief military events.

LETTERS FROM THE PENINSULA, 1808—1812. By Lieut.-General Sir William Warre, C.B. Edited by the Rev. E. Warre, D.D., C.B. 298 pp., with map and index. 8vo. London, 1909. Murray. 10s. 6d.

This series of letters commences prior to the despatch of British troops to the assistance of the Spaniards in the Peninsula, and concludes shortly after the Battle of Salamanca. Though written without any idea of publication in the future, they give a simple and yet interesting description of the life of an officer on the staff during the greater portion of the war. Of special interest are those letters dealing with the characteristics of our Allies and the reorganization of the Portuguese Army, with which the writer served in the capacity of staff officer to Marshal Beresford. Owing to the scarcity of officers having a knowledge of Portuguese, the author's acquaintance with this language, acquired during childhood, was of special service to the army at the commencement of the campaign and during the reorganization mentioned above.

A short introduction to each chapter by the editor gives in outline the main features of each period of the campaign and, together with a chronological table of events, assists in recalling the most important events to memory.

CLEBURNE AND HIS COMMAND. By Irving A. Buck. 382 pp., with illustrations. New York and Washington. 1908. The Neale Publishing Company.

Patrick Cleburne, the future Confederate general, came of an old Irish stock on both sides, and enlisted in the Forty-First Foot at the age of eighteen in disgust at his failure to

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pass a professional examination. He served with the regiment for three years, but as there seemed no prospect of it being ordered on foreign service he bought his discharge, and in 1849 emigrated to America, finally settling at Helena, Arkansas. The outbreak of the Civil War found him a large landowner with a good legal practice and a man of considerable note in his adopted home, and he was chosen Colonel of the Fifteenth Arkansas Regiment. Within a few months he was promoted Brigadier-General, and at the end of 1862 Major-General. He would probably have succeeded to the command of Hardee's Corps if he had not during the winter of 1863–4 advocated the enlistment of negro troops, a step eventually adopted by the Confederate Government when it was too late. Had he been in command of that corps in November, 1864, it is not likely that Schofield's Army would have been allowed to escape at Spring Hill. There would then have been no Battle of Franklin (where Cleburne fell), and Hood's invasion of Tennessee might have had a very different issue.

Cleburne won the proud title of the "Stonewall of the West" by his remarkable personal courage; "men seemed to be afraid to *be* afraid where he was." He was certainly one of the ablest tacticians in the Army of the West, and unsurpassed as a division commander. That no leader could strike a more staggering blow was proved at Murfreesborough, and his splendid stand at Ringgold, which earned him the thanks of Congress, saved Bragg's Army from utter destruction after the rout on Missionary Ridge.

The writer served as A.A.G. in Cleburne's Division, and displays unbounded enthusiasm for his great commander. The descriptions of the various battles are somewhat unsatisfactory, because the author confines himself to narrating the part taken in them by Cleburne's Division only. Thus the account of the Chickamauga Campaign leaves a great deal untold, which is nevertheless essential to a proper appreciation of the military operations.

In spite, however, of defects of style, this work will serve to keep green the memory of one of the most remarkable soldiers of the Civil War, and can be cordially recommended to the attention of the military student.

Major-General J. E. B. Stuart. By Theodore S. Garnett. 61 pp. New York and Washington. 1907. The Neale Publishing Company. 4s.

This address was delivered on the 30th May, 1907, on the occasion of the unveiling of the equestrian statue of General Stuart in Richmond. The orator, Judge Garnett, served during the Civil War as Stuart's aide-de-camp, and his address is naturally an enthusiastic eulogy of his great leader. He considers that Stuart attained the climax of his career on the second day of Chancellorsville, when he was appointed to the temporary command of Jackson's Corps, and he quotes General Alexander in support of the view that Stuart on the reorganization of the Army of Northern Virginia should have been Jackson's successor. He takes some pains to clear Stuart of the responsibility of the failure of the Gettysburg Campaign, but ignores the fact that Lee's consent to the movement round Hooker's rear was conditional upon Stuart's ability to cross the Potomac in advance of Hooker. The account given of Stuart's fall at Yellow Tavern differs considerably from that given by Colonel Gus Dorsey in the Southern Historical Society Papers, Vol. XXX.

Official History of the Russo-Japanese War. Part III. Siege of Port Arthur. (Prepared by the Historical Section of the Committee of Imperial Defence). 4s. 6d.

The present volume deals with the Siege of Port Arthur from the Battle of Nan Shan to the fall of the fortress.

In a short introductory chapter, the history of Port Arthur as a modern fortress and naval base is briefly described. This is followed by an account of the operations culminating in the capture of the so-called "Position of the Passes," and the commencement of the siege. The next four chapters deal with the organization of the 3rd Army as a siege force, and with the three general assaults.

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It is, perhaps, open to argument whether any of these attempts was justified in the conditions under which they were made; but the evidence as to the necessity of making the first attempt would appear to exonerate the Japanese from the charge of headstrong folly with which they are sometimes accused.

Subsequent chapters are devoted to the assault and capture of 203-Metre Hill and to the different attacks on the permanent forts of the north-east front which led finally to the surrender of the fortress after eight months' siege. The descriptions of the Japanese assaults and of the conflicts waged by the opposing forces, when actually within the forts themselves, and often far below ground level, give a remarkable indication of what we must be prepared for in the future, should we at any time find ourselves opposed by troops trained and disciplined to an equal power of endurance.

A SCAMPER THROUGH THE FAR EAST. By Major H. H. Austin, C.M.G., D.S.O., R.E. 322 pp., with 30 illustrations and 2 maps. 8vo. London, 1909. Arnold. 15s.

The author gives an entertaining and instructive account of a rapid journey from England to the Far East and thence to Simla. The topographical details given by him of the Manchurian battlefields which he visited are full of interest. Many useful hints on travel in Japan are contained in the chapters in which the author describes his walking tours in the Japanese highlands off the beaten track of European travellers. Chapter XIV. contains a brief and graphic sketch of the Japanese Grand Manœuvres at Nara. The whole account of the journey demonstrates how much can be accomplished in a limited time, provided plans are carefully made beforehand.

MEDICAL.

AUSTRO-HUNGARIAN ARMY REGULATIONS FOR THE CONVEYANCE OF SICK AND WOUNDED BY RAIL (Vorschrift für Sanitätszüge des k. u. k. Heeres). Official. 197 pp., 7 plates, with drawings in text and tables. 8vo. Vienna, 1909. k. u. k. Hofund Staatsdruckerei. 1s. 10d.

This work is the official manual of hospital trains for the Austro-Hungarian Army; it consists of two main divisions with numerous plates, drawings, and tables. The first division is devoted to "Spitalzüge," which we would call hospital trains. This class of train is fitted up as a travelling hospital capable of supplying all the needs of 144 seriously sick or wounded patients lying down, during a journey of several days if necessary, while being transferred from the area of operations to the hospitals in the home territory. These trains are composed of specially-constructed goods wagons which are employed for traffic during peace time, but are not allowed to be sent out of the country.

The second division deals with "Krankenzüge," *i.e.*, ambulance trains of an improvised nature and primarily intended to carry sick and wounded short distances, and only to afford such medical attendance as may be absolutely necessary during the journey. These trains may be permanent or temporary, and are made up of ordinary goods wagons.

Each army corps has three of the permanent type of improvised ambulance trains in which the wagons are fitted with some apparatus to support stretchers, and with sitting accommodation. The temporary type of train is made up as required of additional goods wagons with improvised accommodation, when a very large number of cases have to be evacuated rapidly.

In the case of both kinds of train, the directions given enter minutely into every detail concerned with the formation, adaptation, equipment, and *personnel*.

The duties of everyone on the train, from the Commandant downwards, are clearly laid down, and all probable contingencies are provided for. The work affords an excellent guide to those who may in any way be concerned with the formation of a hospital train.

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ORGANIZATION AND ADMINISTRATION.

POCKET-BOOK FOR THE TRAIN AND SUPPLY OFFICER IN THE FIELD AND AT MANŒUVRES (Taschenbuch für den Train und Verpflegungsoffizier im Felde und im Manöver). By Lieut. C. Hummel. 134 pp., with diagrams and sketch maps in the text. 8vo. Berlin, 1910. Mittler. 2s. 6d.

A most useful little book containing everything the train and supply officer requires to know as regards organization, lines of communication, orders, supply and reconnaissance. The last chapter but one is devoted to a supply problem in the field.

Paragraph 42 is of interest; it deals with the treatment of hostile inhabitants and reads thus:—

"*Punishments for Hostile Inhabitants.*

"Towns or villages lying on the line of march are to be held responsible for any casualties to *personnel* or injuries to material brought about or committed by hostile inhabitants in their neighbourhood, only the infliction of severe punishment to life and property will induce the authorities and landowners to take action against their own countrymen. Bridges which have been demolished are to be restored by the local authorities under threat of punishment, and obstacles and barricades are to be removed.

"Buildings from which armed inhabitants have fired, or which have served as places of concealment for partizans are to be burnt; every endeavour is to be made to guard against such a fire being put out.

"All hostile citizens found in *flagrante delicto* with arms in their hands have forfeited their lives according to the law of war, and are consequently to be shot without mercy."

THE PEOPLES OF SOUTH-EASTERN EUROPE AND THEIR POLITICAL PROBLEMS (Die Völker Südosteuropas und ihre politischen Probleme). By P. Dehn. 98 pp., with a coloured map. Halle on the Saal, 1909. Gebauer-Schwetschke Druckerei. 2s. 6d.

In this book the author first of all describes the various races which inhabit South-Eastern Europe and then considers their position, aims and aspirations. He points out that most of the nationalities are dissatisfied with existing limits of territory or power and that they either desire independence or, where they have independence, an expansion of territory or conjoint grouping. It is, however, difficult to reconcile the different demands, and in point of fact the "struggle of all against all has only hitherto been held back by pressure from the Powers."

Herr Dehn adopts the following race-grouping:—

(*a*). North Slavs—Czechs, Slovaks, Poles and Ruthenes.
(*b*). South Slavs—Bulgars, Serbo-Croats and Slovenes.
(*c*). Non-Slavs—Magyars, Roumanians, Turks, Greeks and Albanians.

He considers that among these races the people the least entitled to their demands are the Czechs. In this respect, however, the author writes perhaps from a somewhat partial point of view, for he regards their aspirations mainly in the light of the effect which, if granted, they might have on "German" development.

The later chapters deal with the new Pan-Slavism, "a Balkan confederacy," the Austrian Monarchy as a Slav force, the Eastern Crisis in 1908—1909, the future of Turkey and the position of the Powers.

AMERICA AND THE FAR EASTERN QUESTION. By Thomas F. Millard. 576 pp., with appendices, 2 maps, and numerous illustrations. 8vo. New York, 1909. Moffat, Yard & Co. 16s. 8d.

The author commences with a brief general outline of the present situation in the Far East and the relationship of the various interested Powers to each other, and gives his opinion that "Japan is now the most virile disturbing factor."

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With this as a starting point the author proceeds to investigate at length Japan's economic and political *régime*, both internal and external, dwelling more particularly on Japan's dealings in respect of Manchuria and Korea.

One of the leading features in connection with Japan's economic *régime*, as described, is the active financial support given by the Government in developing her commercial undertakings, and a full analysis of the various methods employed is given.

In regard to Japan's exploitation of Korea and Manchuria, the author's comments are in the nature of an *exposé* of alleged Japanese methods, as a result of which the author attributes the cause of a growing suspicion and resentment in the West.

As regards Korea, he sums up the condition in that country as deplorable.

The writer, before leaving this part of his subject, expresses the opinion that "unless certain points are definitely adjusted by means of, if necessary, international pressure upon the Powers in occupation, the 'open door' in Manchuria will continue to be a hollow sham and may lead to the dismemberment of China."

From this the writer discusses the situation as it affects Russia, both politically and economically.

Chapters XXII. to XXIV. are taken up with a description and investigation of the reform movement in China.

The next four chapters are devoted to an analysis of American commercial and political relations with China and the position of foreign residents in that Empire.

The writer is of the opinion that it requires only circumspect diplomatic activity for the United States to become the most influential foreign Power in the Chinese Empire, and that only by direct intervention of the United States can the "open door" be preserved.

Some 100 pages are devoted to the Philippine question from an American standpoint, including a comprehensive review of Philippine affairs generally, both political and economic.

In the closing chapter the writer considers America's strategic position in the Pacific, and discusses at some length the various factors which would enter into a struggle with Japan for supremacy in the Pacific.

The several treaties, conventions and agreements (thirteen in number) between the various Powers which bear on the situation in the Far East are given *in extenso* in the form of appendices at the end of the book.

STRATEGICAL AND TACTICAL.

A THEORETICAL STUDY OF THE DECISIVE ATTACK (Étude théorique sur l'attaque décisive). By Major Buat. 131 pp., with 11 maps and numerous diagrams. 8vo. Paris, 1909. Chapelot. 4s. 2d.

Major Buat does not make use of the term "decisive attack" as in contradistinction to a "holding attack." In his opinion a "holding attack" pure and simple is contrary to all the laws of war, as it must be the aim of each and every attack at least to drive the enemy from his fire position. He does, however, employ the phrase "partial attack," and affirms that the object of such an attack is to attain success in one particular locality, whilst the "decisive attack" on the other hand must aim at securing such a success as will ensure the complete rout of the whole of the enemy's forces engaged. The distinction between the two is thus one of degree and not of kind: each endeavours to thrust back the enemy from the position which he is holding, but to the "decisive attack," involving the employment of greater masses, falls the task of pushing the initial success to the utmost, till by the repelling of counter-attacks, and by the rout of the enemy's reserves, complete and undisputed victory is assured.

As regards the attack itself, the writer's theory is that preparation for it consists solely in obtaining superiority of fire, and that the actual attack cannot be launched till such superiority has been obtained. The advance to a fire position, which he considers in the

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case of infantry should be at about 800 yards or less from the line occupied by the enemy, is thus regarded by him as a merely preliminary measure.

The first chapter is devoted to the theory of the attack, and explains very clearly the principles which he advocates, and the formations he suggests. Each of the remaining three chapters gives a concrete example of a decisive attack, the various movements of both sides being followed out in detail, whilst the positions occupied during succeeding phases are indicated on the maps which accompany the volume.

HANDBOOK OF TACTICS (Handbuch der Taktik). Major Immanuel (German Army). 2 vols. Vol. I., 433 pp. Vol. II., 299 pp., with numerous diagrams in the text. Berlin, 1910. Mittler. 13s. 6d.

This is a revise of the first edition published in 1905. The author, who commands an infantry battalion and is a well-known writer on tactical subjects, states in the preface that the object of his book is not to improve on the teaching of the German regulations, but to give in a compact form a *résumé* of modern tactical ideas. With this object, each chapter, after dealing at length with the German teaching on any subject, concludes with a short summary of the views held in the chief military States on the same question.

The first volume deals with army organization, issue of orders, reconnaissance, marches and tactics of the several arms; the second volume treats of the battle, transport, supplies, communications, medical service and field fortifications. The book concludes with an index.

TRAINING AND EDUCATION.

OPERATION ORDERS (Gefechtsbefehle). Part III. A Study in Orders for a Retreat. By Capt. von Kiesling, German General Staff. 140 pp., with 2 maps. 8vo. Berlin, 1909. Eisenschmidt. 4s. 5d. (For Part II. see No. 8, p. 27).

This is the third of a series of studies in applied tactics by this author. It deals with the operations of an army corps and an infantry brigade forming the right of the IInd Army of a main Red force opposed to a Blue invading force. The imaginary theatre of operations lies south of the Danube, and north of Munich.

The opening pages are devoted to the general and special ideas; the latter sketches in detail the course of the first day's fighting, and the situation at its conclusion. Full particulars are given about headquarters, combatant units, ammunition columns, medical and supply units, and methods of intercommunication. The exhaustive description of the work of one of the divisional staffs begins with the receipt of army corps instructions directing withdrawal to and across a river line, and notifying the approach, from a flank, of hostile forces capable of impeding the projected operation. The G.O.C. Division thereupon decides to assemble, reorganize and rest his command as far as possible before attempting any general movement. The orders which are issued as a result of this decision are given. They take the form of special instructions to the cavalry, and a general divisional operation order. Means of transmission, and other details, are described in each case. The situation opposite one of the infantry brigades at the moment when divisional orders reach it is next described, and all arrangements by the brigade staff are given. A preliminary order sent to regiments, etc., by a mounted non-commissioned officer names the officers commanding sections of defence, gives directions as to patrolling, meals (field kitchens), and issue of further orders. These orders allot bivouacs and billets, name areas whence supplies, wood, water, etc., may be drawn, and give instructions as to protection. A noticeable feature in these divisional and brigade operation orders is the addition, in appendix form, of "special instructions" dealing with distribution of supplies, replenishment of ammunition, disposal of wounded, postal matters, etc.

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Next follows a description of measures taken by two infantry regiments on receipt of brigade orders, one regiment having lost all except one of its field officers, most company commanders, and many others. The reorganization of battalions and companies, reports to neighbouring units, arrangements for bivouacs, supplies, water, ammunition, and care of wounded, are all minutely described.

Then comes a description of the action of the artillery "*brigade*" (*i.e.*, two 6-battery regiments) with the division, when divisional orders reach it, as well as a summary of the situation at this moment. The positions of battery wagons (*Staffeln*) and light ammunition columns are explained. "*Brigade*" orders follow, containing directions for getting guns and all ammunition échelons to the positions ordered. The orders by one regimental commander (six batteries) are given, as are also the arrangements for replenishing regimental supplies from the approaching divisional ammunition column. This closes the orders dealing with the first phase.

Returning to the divisional staff, the author deals with orders and arrangements for the retrograde movement which takes place in composite columns under specially appointed commanders. He then turns to one of the two columns formed, describing the methods whereby its leader communicates with scattered—and in some cases newly appointed—subordinate commanders. We learn, too, the methods by which units are brought to their appointed places on the march, and how transport, etc., is re-distributed. Similar details are given regarding the rear guard which covers the retiring columns. The action of different units which have to break away from the enemy is considered, as is also that of medical officers in charge of retreating columns as far as wounded are concerned. The action of two companies in close contact with the enemy is now described. Their position is attacked just as the order to retire arrives. After a vividly portrayed picture of the loss and re-capture of a bridge, the book gives the decision and consequent measures of a subaltern who, suddenly succeeding to the command here, feels bound to disregard the orders just received. Succeeding pages are devoted to the work of the colonel appointed to command the divisional rear guard, and give arrangements for supplying its foremost units with food and ammunition. Lastly comes a description of the withdrawal of these same units. In a conclusion the author explains the objects of the work, viz., to call attention in a simple manner to the different phases and forms of duties in action, to teach the art of giving orders, and to lay weight on the "positive" as opposed to the "abstract" side of military education. He considers that young officers are placed in command of unduly large bodies in theoretical exercises, and that consequently the elementary basis of their military knowledge is often lacking.

The lifelike pictures of the situation which precede the examination of tactical decisions, and administrative measures in every instance, add greatly to the usefulness of the book. Especially noteworthy are the arrangements for communication between all commanders and units, and for the movements of transport.

A careful system of cross references facilitates the comprehension of a necessarily complicated situation. The extraordinarily clear and short phraseology is rendered possible by the scientific military vocabulary which Germany possesses. The orders are, in fact, models, and the book presents a useful, attractive, and to English readers novel method of teaching tactics and administration. In order to derive full benefit from the book a thorough knowledge of German Army organization, and of the abbreviations so plentifully used in their service, is necessary.

The 1/100,000 tactical map is well suited for the study of the subject matter.

MODERN RIDING. By Major N. Birch. 262 pp., with index. 8vo. London, 1909. Hutchinson. 6s.

Major Noel Birch gives in this book his reasoned opinions as to the best way to train and educate a horse and the man who is to ride it. His views are based on a careful study of the literature which exists on the subject and on the methods employed in other countries, combined with several years' practical experience in the Riding Establishment at Woolwich.

The late Inspector of R.H. and F. Artillery bears witness to the successful results of Major Birch's system, an opinion with which all who saw the performance of the

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Rough Riders of the R.A. Riding Establishment at the Military Tournament will fully agree.

The author addresses his pages especially to the members of the Territorial Force, whose opportunities for passing through riding courses are limited; but the book should appeal equally to every soldier who has to do with horses, and is anxious to improve the efficiency of the men and horses committed to his charge.

NOTES ON ORGANIZATION AND EQUIPMENT. (6th Edition). By Lieut.-Colonel H. M. Brunker. 309 pp. 8vo. London, 1909. Clowes. 7s. 6d.

The last edition of this book was published in 1907, since when numerous changes in the organization and constitution of the Army have taken place. These are shown in the present edition, which otherwise retains the main features previously adopted, and will be found of assistance to candidates for the Staff College and Promotion Examinations.

Examination papers for the Staff College from 1898 till 1907 and for promotion from 1901 till 1909 are given.

The composition of the larger formations and the system of food supply and ammunition supply in the field are clearly shown by means of plates at the end of the volume.

MISCELLANEOUS.

THE ECONOMIC POSITION OF GERMANY IN THE CASE OF WAR (Die deutsche Volkswirtschaft im Kriegsfall). By Dr. Voelcker. 158 pp. 8vo. Leipzig, 1909. Dr. W. Klinkhardt. 3s. 9d.

The object of the work is to determine the effect of war on German commerce, the extent to which the economic system of the country can guarantee its preparedness as regards equipment, rations, etc., and further, by a glance at their probable condition, to draw conclusions as to what precautionary methods should be taken during time of peace to ensure the maintenance of the normal, economic position.

Under the heading of "The War Crisis," the effect on the economic situation during three periods is dealt with. The three periods are: —

(i.). Directly before the expected declaration of war, and during the mobilization and concentration of the army.

(ii.). During the operations.

(iii.). During the armistice and peace negotiations. The arguments are based on statistics during the Franco-German War, 1870-71.

The author then passes on to the discussion of the commerce of the German Empire, which takes the form of a general survey of the home resources and the extent to which the country is dependent on other nations. He devotes some pages to the production and sale of goods, entering into details, with statistics, as to the probable number of working hands available, the industries affected, the possibilities of trading inland and through neutral ports, the mercantile navy in general, and the means of coping with a blockade. This part is supplemented by a survey of the economic condition of some branches of German industry, dealing with the effect of war on the working of coal mines, and on the iron, textile and leather industries.

Under the heading of "German Agriculture in the Case of War," he deals with the possibilities of maintaining the army and the population during the period of hostilities. After a further discussion on the economy of food stuffs, in which he aims at distinguishing between dispensable and indispensable foods as regards human beings and animals, he concludes with the opinion that, owing to her independence from the import of raw products, Germany is in a position to maintain herself for a long period, independently of other countries, notwithstanding her large requirement of imported bread cereals. Owing to her great commercial position, the effect of hostilities would react in a greater degree on the economic systems of her enemies than on her own.

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THE AIRSHIP CRUISER SPY (Der Luft Kreuzer Spion). By J. von Adlerskron. 213 pp. 8vo. Leipzig, 1909. Kummer's Verlag. 4s 6d.

In the preface the author tells us that the editing of these experiences of a French officer of the General Staff, employed on intelligence work in connection with airships in Germany, was confided to him by that officer himself when dying of consumption at Davos.

In an introductory chapter the author enters, in some detail, into the methods of espionage carried out by different States and discusses the various classes of people employed in this service. He lays special stress on the class of information required and the ways and means of getting it. This chapter is perhaps the most interesting of the whole book.

The story itself describes the way in which the French officer is temporarily removed from active service; how he serves an apprenticeship at a wine merchant's in Bordeaux for three months with a view to carrying out his task in Germany under the guise of a travelling agent of the firm; the means he adopts for getting to know individuals connected with the balloon establishment at Tegel; his successful transactions with an assistant paymaster with regard to the purchase of secret information; his methods of securing secret plans of airships; and finally, his hurried departure from Berlin.

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TEMPORARY HOSPITAL CONSTRUCTION.

Bird's-eye View of Mooi River Hospital, No. 4 General, 1900.

Howick Hospital, Natal.—12" Turbine Working.

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TEMPORARY HOSPITAL CONSTRUCTION.

By Capt. G. S. C. Cooke, R.E.

Introduction.—The construction of a field general—or other temporary—hospital, must to a great extent be governed by the nature and resources of the country in which it has to be provided.

If the hospital is required in, or near a modern town, it will probably be possible to appropriate existing buildings for the purpose. Thus, the Maritzburg College and Garrison Church in Maritzburg, Natal, were used as hospitals during part of the South African Campaign.

Such an extemporized hospital has undoubted advantages, as it is more likely to be ready at once for the reception of patients than would be a hospital erected *de novo* with tents or huts and temporary buildings, and in addition to this it would be less susceptible to changes of temperature. On the other hand, the latter can be more easily adapted to its site. Existing permanent buildings, too, are often amongst undesirable surroundings, or are insanitary, inconvenient, and generally unsuited to hospital purposes, and they almost always require to be supplemented and improved.

In the present article it is proposed to consider only a hospital erected *de novo*, from such materials as are likely to be generally available, or are easily imported as war stores.

The examples quoted are taken from the general hospitals and from standing camps, etc., in S. Natal during the South African War, as being those of which the writer had personal knowledge. Howick and Mooi River are especially referred to, as they were very highly spoken of on p. 67 of the "Report of Royal Commission on Care . . . of Sick . . . in South Africa."*

As in the case of permanent hospitals, so in building a temporary hospital the two principal objects to be borne in mind are *convenience* and *sanitation*.

* Mooi River Hospital had been in existence nine months and Howick was just completed when the writer first saw them in September, 1900, and he continued in Natal until after the hospitals and camps referred to had disappeared.

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It is proposed to consider the construction under the following headings :—

(A). Siting.
(B). Buildings to be provided.
(C). Arrangement and order of erection.
(D). Construction of buildings.
(E). Water supply.
(F). Drainage.
(G). Disposal of sewage, refuse, etc.
(H). Other accessories.

(A). *Siting.*—In choosing the site for a field general hospital, military considerations will generally predominate. It must, for instance, be on, or close to the railway or other line of communication, accessibility being an obvious essential. On a line of communications, hospitals should generally be placed at intervals of one or two days' journey, for convenience of convoys. The local availability of supplies is also a consideration.

The salubrity of the place chosen is of very great importance. While the site itself should be open, dry, and gently sloping with no marshy or contaminated ground in the neighbourhood, it should lend itself to drainage, and water must also be available. The soil ought to be light and fairly fertile, and the subsoil permeable. A cheerful outlook is desirable. The absolute and relative elevations of the site should be considered, as also shelter from any prevailing and undesirable winds, etc. Concerning the latter, local knowledge should be sought.

The ultimate decision as to the site will doubtless be given by the staff, but it is desirable that the first selection should be made by the R.E. and R.A.M.C. *jointly*. This last remark applies also to the laying out of the hospital on the site. To secure a good general design in the first instance will greatly facilitate the working of the hospital, and is essential to its efficiency.

(B). *Buildings to be Supplied.*—The number and sizes of the accessory buildings to be supplied will vary somewhat with the number of beds the hospital is built for; and the adoption of tents or buildings for certain purposes will depend on the probable life of the hospital.

In any case, such accessories as latrines, ablution rooms, kitchens, the more important stores, the operating theatre, and special ward should be buildings, not tents (see List (I.) below). Other accessories might be "tented" to begin with, and replaced by buildings if the hospital continued for any length of time.

It would act as a check on excessive demands, if the normal scale on which such buildings should be provided were agreed upon by

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the C.E. and the P.M.O. of either the army or of the Line of Communications.

The following is suggested as a normal scale for a field general hospital (520 beds with power of expansion), and is based upon the accommodation provided at Mooi River and Howick :—

(I.). Buildings Always Required.

Main Hospital.

(i.). Operating theatre, preparation room for operations, and X-ray room with dark room (in one building, about 60′ × 22′).

(ii.). Dispensary and utensil store (60′ × 22′).

(iii.). Special ward (for hospitals with "tented" wards only) (60′ × 22′).

(iv.). Provision store (60′ × 22′).

(v.). Clean linen store (60′ × 22′).

(vi.). Foul linen store (30′ × 22′).

(vii.). Pack store (with a portion at one end partitioned off to take kits in bulk on arrival of convoy) (60′ × 22′).

(viii.). Hospital kitchens (two, 30′ × 22′).

(ix.). Lamp room and oil store (20′ × 16′—not required if the wards and other buildings are lighted electrically).

(x.). Filter shed. (This may be placed under the main storage tanks).

(xi.). Patients' latrines (seats, 10 per cent. of accommodation).

(xii.). Patients' ablution rooms (two, 46′ × 15′, unless these are included in the hut wards).

(xiii.). Officers', sisters', sergeants', and orderlies' latrines.

(xiv.). Orderlies' ablution rooms (30′ × 12′).

(xv.). Enteric excreta enclosure (no roof) (12′ × 10′).

(xvi.). Disinfecting enclosures (two, 10′ × 8′, for surgical and medical divisions) (no roof).

(xvii.). Shed for disinfector (Thresh's or other).

(xviii.). Shed for portable destructor (if provided).

(xix.). Latrines and ablution rooms for sanitary staff.

Isolation Division.

Complete with its own latrines; ablution rooms; kitchen; linen, foul linen, and pack stores; and also dispensary and disinfecting enclosure. The necessity for making the isolation division a complete hospital in itself cannot be over-emphasized.

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(II.). BUILDINGS OR TENTS ACCORDING TO THE PROBABLE DURATION OF HOSPITAL, AND THE CLIMATE.

Main Hospital.

(xx.). Officers', sisters', sergeants', and orderlies' kitchens; also one for sanitary staff.

(xxi.). Recreation room and chapel (60′ × 22′). (The same building can be used for both, but the provision of a separate chapel would be an improvement).

(xxii.). Sisters' night duty room (not very necessary if the wards are huts).

(xxiii.). Orderlies' dining and recreation room. (Even if only a rough building, this adds greatly to the comfort of the orderlies and tends towards efficiency).

(xxiv.). Hospital wards. In South Africa the tents—especially the Indian "E.P." tents—proved nearly, though not quite, as cool as huts in summer, but were colder in winter. Tents however wear out quickly, and it will probably be economical to build huts if the hospital is likely to last for a year or more. The possible utility of the buildings after the war is over should not be overlooked; thus Howick Hospital was used as temporary barracks for two years or so after the war, being occupied in turn by two brigades of R.F.A. and one or more infantry battalions.

(xxv.). Huts for officers and sisters.

(xxvi.). Huts for N.C.O.'s and men.

(xxvii.). P.M.O.'s offices, etc.

(xxviii.). Sergeants' Mess.

(xxix.). Officers' and Sisters' Messes. (Tent messes of two marquees forming a **T** are very comfortable).

(C). *Arrangement and Order of Erection.*—Administrative buildings should be centrally placed, and sanitary accessories should be located where they will be the least nuisance, while not too far from the wards.

The arrangement adopted at Howick and Mooi River is convenient and meets the case, the administrative buildings being in the centre, with the medical and surgical divisions on either side, and the isolation division being separate. It would however have been better to have had two kitchens, so placed that each could conveniently serve half the hospital, and not too close to the operating theatre or special ward on the account of the smell of cooking.

The facing of the camp as a whole will depend on the prevailing wind, the sun, and the slope of the site.

Drainage will be simplified if buildings are erected at an angle to the contours (a *slight* angle if the slope of the ground be con-

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siderable), instead of along them; the best aspect for hut wards is with their long axes N. and S.

If the latrines, etc., be placed at a reasonable distance from the wards and be well kept, no nuisance will arise from them.

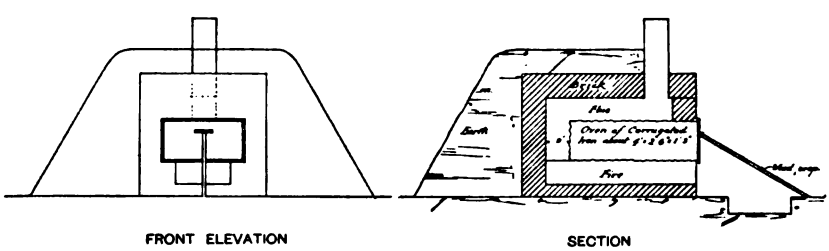
As already stated, a separate isolation division, complete in itself, with accessory buildings, stores, and kitchen, is very desirable, and would be an advance on South African practice.

As essentials *must* come first, and a part of all absolute essentials to meet initial requirements should be proceeded with simultaneously, the order of erection is simply decided, viz.:—

Latrines (with their surrounding drains).
Drainage.
Water (this can be carted as a temporary measure, but the sterilizing apparatus should be installed very early).
Ablution rooms.
Destructors (if portable ones are available, time will be saved).
Hospital kitchens. At Howick patients arrived before kitchens were complete. Field kitchens and a corrugated iron oven (see sketch) were used meanwhile.
Operating theatre.
Other buildings.

Sketch of Improvised Ovens used temporarily at Howick Hospital.
(Designed by S.S. Gordon, R.E.).

Scale—$\frac{1}{8}$"=1'.



FRONT ELEVATION SECTION

It must be remembered that while many things can be temporarily accommodated in tents, *sanitary accessories cannot be so accommodated.*

(D). *Construction of Buildings.*—The general construction of temporary buildings need not be treated fully; a summary of general principles is enough.

Very light scantlings will suffice, timbering being merely a support for corrugated iron, which braces itself. For this reason, as well as for others, with all its faults corrugated iron—24 gauge—would seem to be the best material for temporary work. The buildings should be designed so as to save cutting the corrugated iron, and to allow of utilizing sizes ordinarily imported. Elaborate timber joints should be avoided, and ready-made flooring, doors, and windows used as far as possible (American doors and Baltic windows are best). If white ants exist,

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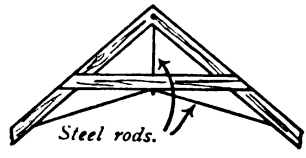
the piles should be of a wood which they do not like; creosoted railway sleepers are good, but there will probably be some local wood which termites dislike, *e.g.*, "Sneezewood," in Natal. The building is then erected as follows :—Piles, bottom plates, floor joists (if any), side timbers, gable ends (put together on ground), roof timbers and covering, windows and side covering, then flooring, and finally complete inside.

As walls will take no thrust, roof trusses *must* have ties (or collar ties placed rather low) ; a useful and simple pattern is as sketched.



The whole floor level of wooden floored buildings should be kept above ground; and the ground should not be cut into to level the site, but the building should be raised on piles. With earth or concrete floors, as little cutting as possible should be done, low ground being made up instead. There is no harm in floors of temporary buildings having a slight slope if they drain clear.

It is desirable that the ground under the floors of inhabited buildings should have a layer of concrete (2″), graded to drain dry. If this cannot be done, the floors should be raised well off the ground and the latter should be left open to the air, the space below such buildings being enclosed with netting, to keep out vermin.

Surface channels are needed round buildings (with or without eaves gutters) to carry off storm water.

To cool buildings, limewhite can be made to adhere to galvanized iron by adding salt or tallow. If the climate is a very hot or a very cold one, some roof-cooling compound might be tried ; and even with moderate heat it is well to ventilate the space between roof and ceilings of wards and other lined buildings, by raising the ridging and leaving the space under eaves and behind fascia boards open.

Timber flooring is recommended for wards and recreation rooms. All other buildings need a concrete or other hard floor, and enteric excreta enclosures (in which excreta are collected and mixed with disinfectant), disinfecting enclosures, and destructor and disinfector sheds require the floors tarred.

Wards.—Neither matchboard nor calico form a sanitary lining. Willesden paper (4-ply) is suggested. The makers say it will take paint or distemper ; it is washable, portable, and cheap, and joints can be made dust tight. The paper might perhaps be painted with Silicate paint.

Plenty of windows should be allowed, and a proportion of small wards should be partitioned off for acute cases. Howick Wards,

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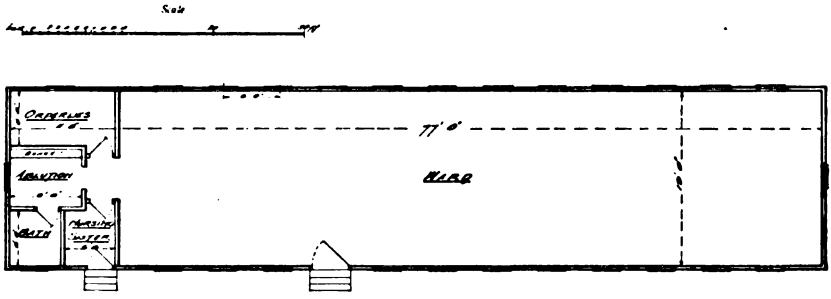
otherwise good (see plan), were deficient in this respect. Doors should be wide, to admit stretchers. Medical officers like curved ventilators at ends, made to open and close. In hot climates wide verandahs, on the sunny side at least, are needed.

Howick Hospital—24-Hut Ward.

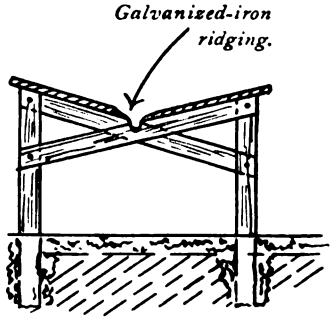


Operating Theatre and *X-Ray Room* (in one building). *The former* needs a preparation room attached; must be lined; should be painted white; have overhead light with blinds; and all its corners and angles should be rounded. The use of a smooth, impermeable, and washable lining material is especially important here. The floor also should be impermeable (not wood), raised in the centre and graded to a gutter all round. Water must be laid on; hot water should be arranged for; and a suitable sink provided. *The latter* need not be lined, but is better so; should be painted dark, with heavy curtains to windows. A dark room with sink, rack, and ruby window should be annexed.

The various *Store Buildings* require no lining, only rough racks and shelves for fitments.

The *Main Kitchens* need eight 72″ cooking ranges (for 1,000 beds), besides shelving, etc. (Soyer's stoves from A.O.D.). A hot table made like a hot tray is useful.

Latrines (*dry earth*) and *Ablution Rooms.*—Floors (concrete) must drain dry (to the rear in latrines). They should be surrounded by drains (see under "Drainage"). Walls should not reach to floor below or roof above. All salient angles should be chamfered in concrete.



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Space should be provided in latrines to stand urine tubs (night urinals are not needed in a hospital), and plenty of dry earth boxes should be supplied to latrines. For ablution rooms a simple pattern of bench is as sketched.

With Tent Wards stands must be provided behind each, of wood or concrete tarred, to take bed pans, chambers, and slop pails. Though not essential, it would be well to concrete the ground under tent bottoms. (P.M.O.'s will probably have tarpaulins laid over the latter).

The Hospital Enclosure should be fenced—the isolation division separately.

(E). *Water Supply.*—On active service water will very often have to be taken from a "doubtful" or even "dangerous" source. Hence water supply resolves itself into :—

(I.). Actual supply of water.

(II.). Sterilization of impure water.

(I.). Unless local conditions render it impossible (which is unlikely), water would be laid on by pipes, and separate systems of washing and drinking water may be desirable. The use of screwed pipes, even up to 3″ and 4″, is recommended for temporary work, as they are easily laid, taken up, and relaid.

Carting water is never satisfactory for any length of time, but if it has to be resorted to, a suitable hard place for carts to stand on when being filled should be provided, and drainage from this place should not be able to reach the intake.

The medical authorities can be trusted to see that the carts are kept in sanitary condition. If however carts are used to carry drinking water, they should be kept quite distinct (differently painted) from all others, and provision should be made for sterilizing them periodically by injecting steam from a high pressure boiler.

The possible sources of water, being a subject in itself, cannot be discussed here ; but if the supply be from a stream, the intake should be above every source of pollution that can reasonably be avoided.

For raising water, steam pumps are most generally used, and of these, the Steam Worthington is usually the most convenient pattern. They were largely used in South Africa during and after the war. At Mooi River Hospital however a small portable Merryweather Steam Valiant was installed, which, against a lift of 100′, supplied the hospital for over two years. It was a very compact machine, pump and boiler being complete in one.

As a number of steam pumps will almost certainly be required in a campaign for hospitals, standing camps, remount depôts, etc., it might prove well worth while to take out at the beginning of operations, as war stores, a number of semi-portable pumps and boilers of varying capacity, and on wheels complete.

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Although steam pumps are general, other means of raising water may be useful. At Howick, for instance, advantage was taken of a small waterfall in the river Umvoti to drive a 6″ Little Giant turbine, working two vertical double throw pumps, which supplied the hospital and convalescent depôt for many months.

These pumps were later replaced by a single larger pump, and when the three large Boer refugee camps (for about 5,000 persons) were built, a 12″ turbine was also installed, working a single cylinder geared pump, supplying all the water required for refugees, hospital, and convalescent depôt, the smaller turbine being kept in reserve (see photo).

A duplicate plant, or at least some scheme for supplying water in case of temporary breakdown, is most necessary, and storage tanks holding one day's supply are also desirable.

When purchasing pumps, boilers, etc., the usual and best method is to state the exact conditions of lift, distance, etc., and required delivery, calling upon firms consulted to quote for a machine capable of performing the duty named. The Construction School, S.M.E., issues a paper (No. 152) on this subject.

In estimating requirements allowance for possible increase should be made, as, *e.g.*, a convalescent depôt might be added later.

(II.). Sterilization of Impure Water.

Sand filters not being practicable, the efficient feasible methods are few, namely :—

(i.). *Boiling.*—This is effective if properly carried out. To attain this end it is advisable that it should be done in bulk by R.E. (Colonel Sim's system), otherwise it is difficult, even with the most careful supervision, to ensure all water being boiled ; medical officers, too, are busy enough without having "water boiling" by their staff, to supervise.

The system mentioned is worked as follows (see Appendix VII., p. 114, Report of Enteric Fever Commission) :—

Three sets of tanks are installed, each holding one day's drinking supply (estimated liberally).

One set is boiled each day by the injection of steam from a boiler, until the temperature reaches 200° to 210° Fahr. They are kept at this for about half an hour, and then allowed to cool, being used on the third day.

This system was introduced in Ladysmith (after the siege) by Colonel Sim. It was also adopted for the Mooi River standing camp after the war, where 4,000 gallons were boiled daily by two vertical cross-tube boilers (6 and 4-H.P. nominal, I think). These boilers and the pumping plant were worked by one engine driver. Samples (*a*) from intake and (*b*) from a drinking tap, where taken

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without warning by the S.M.O., after the system had been in use some months (a year or 18 months, I think), and tested in the Government Bacteriological Laboratory. (*a*) was described as being "from a dangerously polluted source" and (*b*) as "quite sterile."

The principal drawbacks to boiling are, first, the cost of fuel, and second, the flat and insipid taste produced.

(ii.). *Sterilizers* (such as the "Maiche").—The principle on which these work is that of bringing water to a temperature of about 212° Fahr. *under pressure*, and then allowing it to cool. This prevents the dispersion of dissolved gases.

The "Maiche" has an "exchange heater," wherein the outgoing sterilized water is cooled by giving up its heat to the incoming unsterilized water, thus economizing fuel. It has also an ingenious automatic control valve for maintaining a uniform temperature. One was brought to South Africa by Colonel H. E. Rawson, and used at Maritzburg for several years. Its chief defect was inaccessibility of the parts, with the result that, when finally overhauled, a leak was discovered which nullified the sterilization. This was repaired, and the parts were made more accessible to inspection.

(iii.). *Pasteur-Chamberland Filter.*—The efficiency of this filter in removing bacteria from water may, I think, be taken as sufficiently proven, though a few remarks may not be amiss. In a thesis published in August, 1894, Surgeon-Major (now Lieut.-Colonel) H. H. Johnston, A.M.S., describes experiments made with this filter, the "Berkefeld," and some others*; the results proved the Pasteur-Chamberland to be the only reliable one. Since then the makers of the Berkefeld claim to have improved their filter, and regard the thesis as out of date. In an article however written for the Journal of the R.A.M.C., April, 1902, Lieut.-Colonel Johnston, C.B., R.A.M.C., shows that in five months, while Berkefeld filters were in use at Mooi River Hospital, 31 cases of enteric were contracted by orderlies, while in the succeeding 26 months, with a "P.C." filter (an automatic syphon action one of 336 candles), only six cases occurred. This filter is therefore probably the best method to adopt.

If the water be muddy it should, prior to boiling or filtering, be either passed through broken brick and sand (or something similar), or else treated with alum.

Unless the whole of the water supply can be sterilized, which is most unlikely, the provision of two separate systems of supply pipes is strongly advocated. Although this was not done in the Natal hospitals, it would have been a distinct improvement to them, and was adopted with great success in the Mooi River Camp, where one system led direct from the main storage tanks to the ablution rooms

* The new Brownlow filter was not, I believe, then invented, and I am ignorant as to its merits compared with the Pasteur-Chamberland.

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and horse troughs only, while the other was taken to the cook-houses and to standpipes between the lines of tents, all taps bearing boards marked "Drinking" or "Unfit for Drinking."

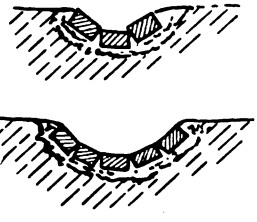
(F). *Drainage.*—Storm water must be led away from buildings and roads, etc. Surface drains will suffice for the purpose, and, if the soil be hard or the rainfall small, the earth channels need not even be lined.

Should a water-carriage system be decided on for the latrines, the foul drains should be laid as in permanent work to a radius of 100 yards from the nearest building or thoroughfare, beyond which hastily made joints would suffice.

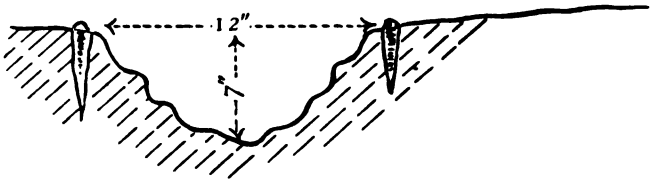
With dry earth latrines the surrounding drains should lead to sunken tanks (or other lined pits), which would be emptied daily, the contents being pumped into sanitary carts and removed therein.

Drainage from ablution rooms, cook-houses, and operating theatre (especially the latter) may be treated similarly, or may be led away in lined surface channels to a distance of at least 100 yards from the nearest building, discharging into a stream direct, or into an unlined pit filled with breeze (or some such material), the storm water either going with it or being disposed of separately. A breeze pit, 60′ × 20′ × 5′ deep, was successfully used at Howick.

Surface drains, taking foul water, must be lined. A brick lining is advocated in preference to concrete, being quickly laid and easy to repair. A good section is as shown, the centre brick being slightly dropped.



Drains lined with corrugated iron were laid in some Natal camps, *e.g.*, Convalescent Depôt and Refugee Camps, and proved quite satisfactory. Their section was as below.



Where ever traffic crosses surface channels the latter should be bridged. Railway sleepers make a good bridge for wheeled traffic, and tarred planks for foot passengers.

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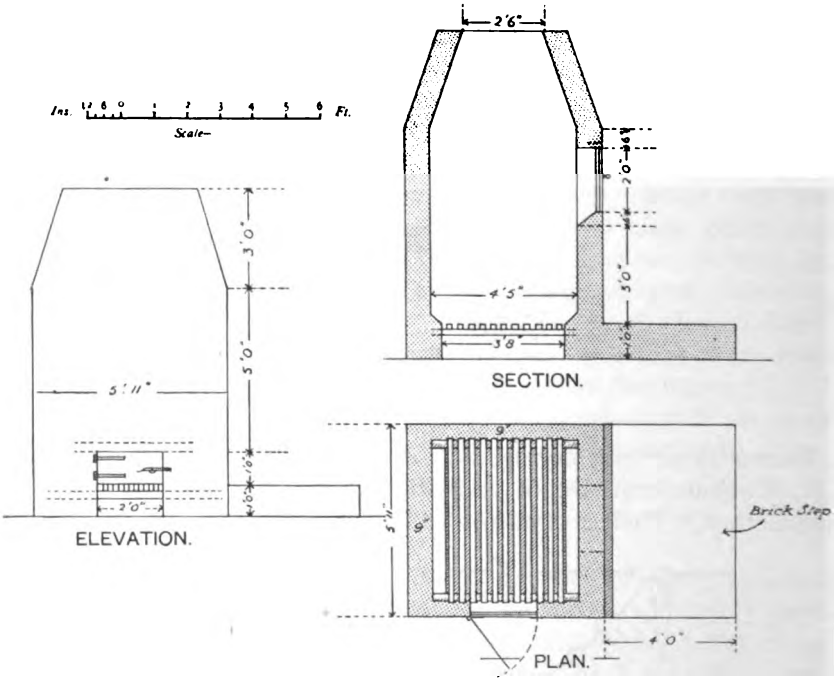
(*G*). *Disposal of Refuse, Sewage, etc.*—The method of sewage disposal depends on the adoption of "dry earth" or "water carriage" for latrines; other sewage can be dealt with as above. If a permanent foul drainage system is handy, it may be well to adopt water carriage and connect to it; otherwise, although sewage might be taken to a river or a septic tank, or land treatment be improvised, the dry earth system would most probably be favoured by medical opinion. The disposal of night soil is not a R.E. service, and it will suffice that sewage, whether liquid or solid, should be buried in trenches 3′ wide, 1′ apart, and not more than 9′ deep, these trenches being at least a mile from any habitation.

An earth ramp with a corrugated iron shoot should be provided for emptying slops from hand-carts into croly carts.

All enteric (and other infectious) excreta *must* be burnt.

This leads to the disposal of refuse generally, including the various forms of highly infectious and offensive matter inseparable from a hospital.

Natal.—Mooi River, 29. 6. 01.—*No. 4 General Hospital, L. of C.*
Detail of "Rubbish Destructor."



In a book entitled *Small Destructors for Institutional and Trade Waste*, Mr. Goodrich, Assoc. Inst. Public Health, lays stress on the necessity of destroying all such matters by fire. On p. 63 he quotes from Dr. Poore's *Colonial and Camp Sanitation* with reference to faulty scavenging on Salisbury Plain; and on pp. 64 and 65 he

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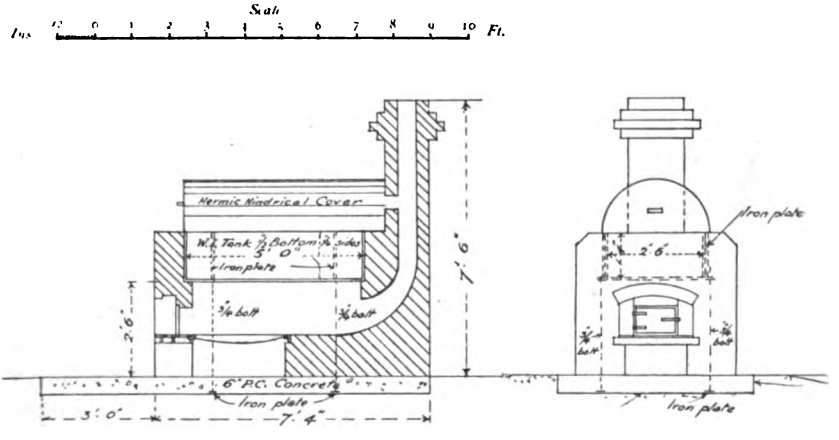
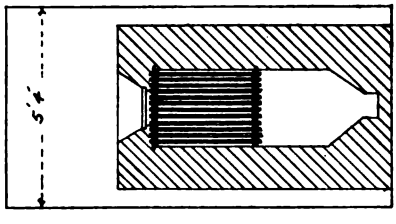
refers to the evidence of Sir C. Warren, Surgeon-General Jameson, and Dr. Fripp before the S.A. War Commission, advocating the destruction by fire of all such refuse. From Dr. Fripp's evidence the author draws the conclusion that no destructors or incinerators were used in South Africa. This was not however the case, and sketches are given of the patterns improvised in Natal (other patterns were used elsewhere).

The incinerators at Mooi River, to take an example, were worked thus :—Two incinerators (for 400 enteric patients) were built side by side, with another shallow tray over a third fire between them. The excreta mixed with izal and sawdust were placed in the two outer trays, reduced nearly to dryness, then dried on the central tray, and finally burnt on the fires below.

Natal.—Mooi River.—No. 4 General Hospital, L. of C.
Sketch of Incinerator.



SECTION. FRONT ELEVATION.



PLAN.

The smell was the main fault, which the hemi-cylindrical covers, added as an improvement, did not entirely cure. To obviate this, Mr. Goodrich emphasizes the necessity of forced draught and high temperature. In his book (Chapter IV.) he describes some portable

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patterns :—One by Horsfall destroys 4 tons daily (its own weight not given) ; another by Meldrum Bros. consumes 5 and weighs 7 tons (cost something over £500). The latter firm however inform me that they have now introduced a smaller portable pattern destroying $3\frac{1}{2}$ cwts. an hour, and weighing 3 tons only (cost £300). This is more hopeful, though if several firms were asked to compete, something still better might result.

(H). *Other Accessories.*—The need of a *disinfector,* such as Thresh's Steam Portable, need not be emphasized. A shed should be provided, partitioned in the centre round the body of the disinfector, and having a door at each end. Infected clothes enter by one door, and disinfected clothes pass out by the other. The floor should be of concrete tarred.

A cemetery is another necessity. It should not be too close to, and if possible be out of view of, the hospital. There should be no possibility of its contaminating water supply, and endeavours should be made to select a site on public land (Crown or municipal).

If the hospital be near a railway line, a *railway siding* is most desirable (on a short branch line if need be), where patients can be entrained and detrained quietly and without hurry, and where hospital trains arriving late at night may remain undisturbed till morning (*e.g.*, Howick Hospital).

A telephone between hospital and station is another useful adjunct.

Roads need not, I think, be dwelt upon ; their necessity is, or should be, obvious.

Lighting.—It may prove economical to light the hospital by electricity, especially as current is required for charging X-ray batteries. Current may be supplied (as in Natal) from accumulators brought by rail in special trucks, and kept on a siding ; or an engine and dynamo may be installed.

Thus at Mooi River the Natal Government Railway ultimately erected an engine and dynamo on a locomotive under-frame, lighting the station yard, hospital, and village. At Howick a dynamo captured from the Boers was driven by a small horizontal engine.

Finally a *flagstaff*—for the Red Cross flag by day and the "two white lights" by night—must not be forgotten.

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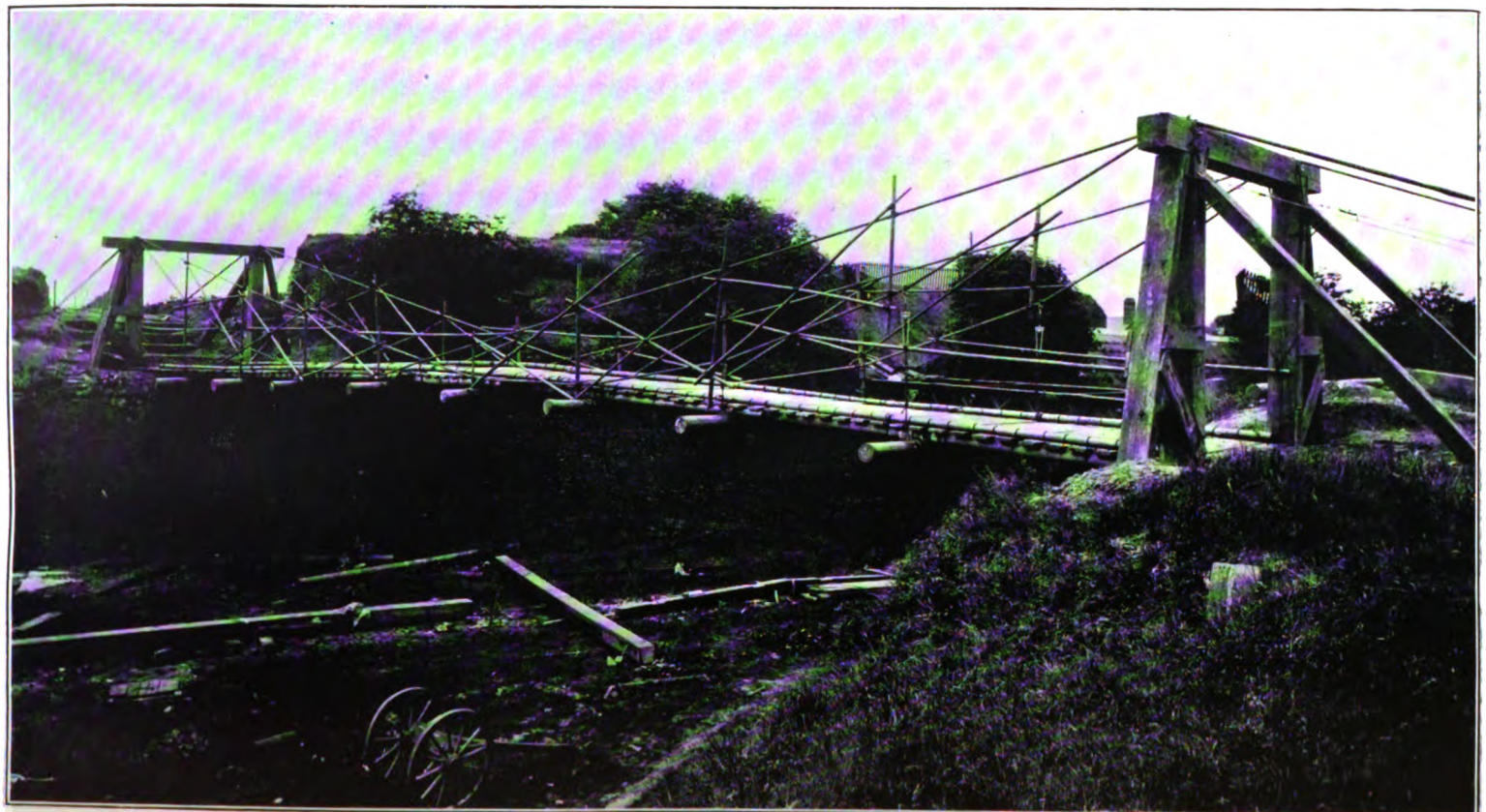
RIGID SUSPENSION BRIDGE.



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RIGID SUSPENSION BRIDGES.

By CAPT. C. E. P. SANKEY, R.E.

A SUSPENSION bridge of a somewhat uncommon type was erected by the 5th (Field) Company, R.E., at Aldershot, in their annual course of instruction in military engineering for 1909, and a similar one was subsequently built at Chatham in the same year, by a party of young officers. As the type possesses several distinct advantages, it is thought that a description of it might be useful. It will be seen that it could be made by unskilled labour, and that the materials required, over and above the cables, are likely to be available in most places in the field.

It consists essentially of two parabolic semi-ribs, hinged together at the centre. Each semi-rib consists of a straight upper member, and a parabolic lower member, the two being united by diagonal bracing.

It has been said that this type of suspension bridge is uncommon, but it cannot be called novel. It seems to have been proposed as long ago as 1861, and was afterwards elaborated by Mr. Claxton Fidler in 1875. It is considered fully in his book on the Construction of Bridges, and concisely in Major (now Brig.-General) Scott-Moncrieft's *Principles of Structural Design*. It has been applied to the shore spans of the Tower Bridge in London. Its possibilities as a field suspension bridge were realized by Lieut. (now Capt.) R. Ommanney, R.E., who erected a bridge of this type about the year 1898.

The cables of an ordinary suspension bridge will hang in a parabolic curve symmetrically about a vertical axis through the centre of the span, assuming that the tops of the piers are at the same level on either side, and that the whole bridge is uniformly loaded horizontally, either with the dead weight of the structure alone, or with a load of traffic in addition. This will no longer be the case if the traffic is not uniformly distributed, as for instance when the head of a body of troops crossing the bridge is still somewhere on the span. The more heavily loaded portion of the cables will be depressed, and therefore the more lightly loaded portion elevated, the roadway being distorted in accordance. If the only load on the cables were that of the traffic, the loaded portion would hang in a parabolic curve, the unloaded portion being straight, and tangential to the loaded portion. As however the dead weight of the structure still remains uniformly distributed, the curve assumed by the cables will be intermediate between this and the symmetrical parabolic curve. The greater the weight of traffic in proportion to the dead weight of the structure, the

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greater will be the distortion, therefore in field suspension bridges, where the spans as a rule are short, and where the dead weight is kept as small as possible, this distortion, with the consequent oscillations, becomes a very important point.

The greater the dip of the cables, the greater will be the distortion produced by the moving load, and therefore the dip has to be kept small, generally not more than 1/10 and often less, although this leads to a great sacrifice of constructional economy.

To prevent distortion and oscillation as far as possible, various devices are employed, such as inclined ties, struts at the shore bays, inverted cables below the roadway, and so forth ; but all such measures only partially remove the want of stiffness that is inherent in the original design.

It is however possible to design the structure so that no distortion is produced by the moving load, except that due to the elasticity of the materials employed.

One such method of construction is to employ rigid roadway girders, supported by the flexible cables. This has several disadvantages. If the girders are continuous across the span, an increase in the length of the cables, due to a rise in temperature, will place a large extra stress on the girders ; in order to meet this, they must be made of a far greater strength than that required to give rigidity. If the girders are hinged in the centre, they can accommodate themselves to this elongation of the cables, but, in order to give rigidity to the structure, must be made strong enough to carry the load over half the span, while the cables must still be strong enough to carry the load over the whole span, as well as the weight of the girders.

Another way, and a far more satisfactory one, is to make the curved members themselves rigid, as in the design under present consideration.

The principle of this method will be best understood by a reference to the diagrammatic construction shown in *Fig.* 1. Let AB represent

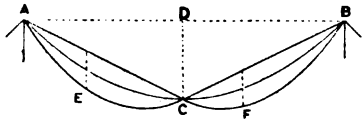

FIG. 1.

the tops of the piers, and let ACB be a parabola, having any required dip, CD, at the centre. Join AC and BC. These will represent the upper members of each semi-rib. The lower members, AEC, BFC, are found by determining a series of points, E, F, such that their vertical distances to the original parabola are equal to the distances between the upper members and the original parabola, in the same vertical planes. The original parabola will thus become the neutral axis of the rib, that is, the line which everywhere bisects its vertical depth.

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These ribs are then divided into panels by verticals at intervals, preferably at the points of attachment of the slings, and cross-bracing added to each panel, as shown in *Fig.* 2. The slings can be attached either to the lower or to the upper member. The latter involves the transmission of the stress through the cross-bracing, and the former thus seems to be better.

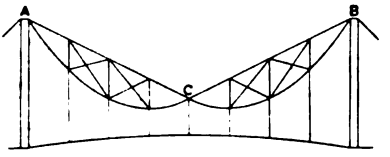

FIG. 2.

It is obvious that if these semi-ribs are strong enough to withstand the bending moment produced by a non-uniformly distributed load, no distortion can take place. It will be shown that the united sectional areas of the upper and lower members need be no greater, or very little greater, than that of a single flexible cable, designed to carry the same total load; and having this sectional area, that they will resist the bending action of the unequal load, without suffering any greater stress.

As rigidity is secured by this design, the dip of the neutral parabola is only limited by the permissible height of the piers; and by increasing the dip, considerable economy can be introduced.

Referring to *Fig.* 3, if the span AB be taken as a, and the dip CD as d, the equation to the neutral parabola, referred to the

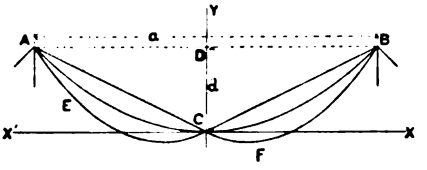

FIG. 3.

tangent at the vertex, and a vertical line through the vertex, as axes, will be

$$y = \frac{4d}{a^2} x^2$$

and the equations to the straight lines AC, BC, will be

$$y = \mp \frac{2d}{a} x.$$

Therefore, by the method of construction, the equations to the lower members will be

$$y = 2\frac{4d}{a^2} x^2 \pm \frac{2d}{a} x,$$

which may be written

$$\left(y + \frac{d}{8}\right) = \frac{8d}{a^2}\left(x \pm \frac{a}{8}\right)^2.$$

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That is, they are parabolas, whose axes are vertical, whose vertices are at the points

$$\mp\frac{a}{8}, \quad -\frac{d}{8}$$

and whose *latera recta* are half that of the original parabola.

Moreover the straight lines AC, BC,

$$y = \mp\frac{2d}{a}x$$

meet the tangent at the vertices of the parabolas of the lower members, whose equation is

$$y = -\frac{d}{8}$$

in the points

$$\pm\frac{a}{16}, \quad -\frac{d}{8}$$

respectively, and thus by a well-known property of the parabola, the upper members AC, BC, are tangential to the curved members BFC, and AEC, respectively.

It will be seen therefore that the lower member of each semi-rib, if uniformly loaded horizontally, will hang in equilibrium, together with the upper member of the other semi-rib, and that there will be no stress in the web of each semi-rib, that is to say, in the verticals and the cross-bracing.

It has been assumed above, and will be assumed in the subsequent calculations, that the points of suspension are sufficiently numerous to consider the cables as hanging in parabolic curves, and not in polygons. This assumption simplifies the calculations and will not diminish the practical accuracy of the general results.

For a uniform load of w per unit of length, it is therefore possible to work out the tensions in the cables, assuming that each half of the bridge, the left for example, passes over two piers, A and C, of unequal height. It will be found that their values are as follows :—

Horizontal tension at lowest point

$$=\frac{wa^2}{16d}.$$

Tension at higher pier A

$$=\frac{wa^2}{16d}\sqrt{1+\left(\frac{6d}{a}\right)^2}.$$

Tension at lower pier C

$$=\frac{wa^2}{16d}\sqrt{1+\left(\frac{2d}{a}\right)^2}.$$

This last tension will be the uniform tension in the upper member, BC, of the other semi-rib.

Were the ribs to be replaced by a single flexible cable, hanging in the neutral parabola, the tensions in that would be as follows :—

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Horizontal tension at lowest point

$$\frac{wa^2}{8d}.$$

Tension at piers

$$\frac{wa^2}{8d}\sqrt{1+\left(\frac{4d}{a}\right)^2}.$$

That is, the horizontal tension throughout the single cable is exactly twice the horizontal tension throughout each cable of the rigid system, while the direct tension in the single cable at the piers is rather less than twice that of the lower members at the piers, and rather more than twice that of the upper members, of the rigid system.

To illustrate this by a numerical example, suppose the dip to be 1/10 of the span, then

Rigid System.

Horizontal tension in each cable	...	...	·625 *wa.*
Tension in lower member at pier	...	...	·729 *wa.*
Tension in upper member	...	...	·637 *wa.*

Flexible Cable.

Horizontal tension	...	...	...	...	1·250 *wa.*
Tension at piers	...	...	...	...	1·346 *wa.*

This shows that practically speaking, the total sectional area of the two cables of the rigid system need be no more than that of the single flexible cable for the same uniform load.

So far nothing but a uniform load has been considered, but as this design is principally intended to meet the case of a moving load, it must now be dealt with. For this purpose, the method of calculation employed by Mr. Claxton Fidler is more suitable, and as the question is gone into very thoroughly in his book on Bridge Construction, it will here be sufficient to touch upon it briefly.

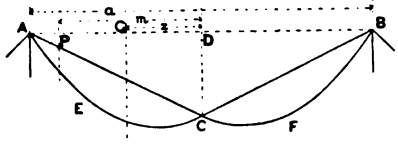

FIG. 4.

He proves that the horizontal component throughout the system, shown in *Fig.* 4, when uniformly loaded, is a tension

$$\frac{wa^2}{8d}$$

equally divided at all sections between the upper and the lower member, that is a horizontal component tension

$$\frac{wa^2}{16d}$$

in each, an expression that agrees, of course, with that found above.

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The load w per unit of length is made up of two portions, p per unit of length due to the dead weight of the structure, that can be considered as always uniformly distributed, and q per unit of length due to the traffic load, that may be on the whole, or on any portion of the bridge.

It may be noted here, that throughout the investigation, the expressions given by Mr. Claxton Fidler refer only to the horizontal component of the stress at any point. To obtain the direct stress, this value must be multiplied by sec θ, where θ is the inclination of the member at that point to the horizontal.

He then shows, that for a dead load of intensity p, uniformly distributed over the whole span a, the horizontal tension at any point of the upper or lower member is

$$\frac{pa^2}{16d}$$

and that this loading produces no stress in the diagonal bracing.

If the live load covers the span, its intensity being q, the horizontal tension due to this is

$$\frac{qa^2}{16d}$$

and as before, there is no stress in the diagonal bracing.

The sum of these two is of course the same as the expression found previously, for

$$w=p+q.$$

When the traffic load exactly covers the half-span AC, the horizontal tension due to this load at any point of the lower member of AC, or of the upper member of BC, is

$$\frac{qa^2}{16d}$$

and as far as this load is concerned, no stress is produced in the upper member of AC, nor in the lower member of BC, nor in the diagonal bracing. This is accounted for by the fact, shown previously, that the members AEC and CB together form a cable in equilibrium under such a load.

The maximum and minimum horizontal stress in any portion of the lower member AEC, due to any position of the moving load upon the bridge, will be, as a maximum, a tension

$$\frac{(p+q)\,a^2}{16d}=\frac{wa^2}{16d}$$

and as a minimum, a tension

$$\frac{pa^2}{16d},$$

that is, the member will always be in tension.

Still referring to *Fig.* 4, the greatest stress producible by the moving load alone, at any point P of the upper member AC, occurs

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when that load extends from G to B, the distance GD, or z, being equal to

$$m \frac{a}{a+2m}$$

where m is the horizontal distance PD.

The value of its horizontal component is then a tension

$$\frac{qa^2}{16d}\left(1+\frac{2m}{a+2m}\right).$$

If however the moving load extends from A to G, with no traffic load on the remainder of the span, the resulting horizontal stress at the point P, due to the moving load, is a compression

$$\frac{qa^2}{16d}\left(\frac{2m}{a+2m}\right).$$

The maximum and minimum values of the total horizontal tensions at P will therefore be, maximum,

$$\frac{a^2}{16d}\left\{p+q\left(1+\frac{2m}{a+2m}\right)\right\}$$

and minimum

$$\frac{a^2}{16d}\left\{p-q\left(\frac{2m}{a+2m}\right)\right\}.$$

It will be seen at once that a difficulty arises here, for in order that the minimum stress at the point P may be a tension, and not a compression, it is necessary that p be not less than

$$q\left(\frac{2m}{a+2m}\right).$$

In permanent bridges of any considerable size, it is probable that this supposition holds good and that the upper member is always therefore in tension; but in field bridges, where the traffic load is, generally speaking, large compared to the dead weight of the structure, this may be by no means the case for certain positions of P, and thus the cable composing the upper member may have a stress produced in it at those points, that it is not capable of resisting.

In order to make this investigation as simple as possible, it may be noted that it is not worth while, nor indeed practicable, in field structures, to alter the section of the suspension member in proportion to the varying stresses at different points. That is, the same sized cable will be employed throughout the system and it will be sufficient therefore to consider the worst case.

It will be seen that the expression

$$\frac{2m}{a+2m}$$

increases with m, and assuming as before that the number of panel points is large enough to treat the cables as continuous curves, m may

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be given a maximum value of $\frac{a}{2}$, and then the expression becomes equal to $\frac{1}{2}$.

Thus the traffic load q must not be more than twice the dead weight p, to ensure that the upper member has no portion in compression.

It may be noted that when $m=\frac{a}{2}$, z will $=\frac{a}{4}$, and thus the extreme cases occur when the traffic load is over three-quarters, and one-quarter, of the span, respectively.

Take the case of a bridge with a span of 100′ and 10′ bays, to carry infantry in fours. The dead weight of the structure may be estimated as follows :—

Cables and slings	15	lbs. per	foot-run.
Road-bearers	50	„	„
Transom	20	„	„
Planking	65	„	„
Verticals and bracing	10	„	„
Ribands...	15	„	„
Handrail, etc.	5	„	„
Total...	180	„	„

Thus p may be taken as 180.

On the other hand, the weight of infantry in fours is generally taken as

560 lbs. + 50 per cent.
840 lbs. per foot-run,

and thus the necessary proportion of dead weight to traffic load is very far from being obtained.

There is however another way of looking at this question. The weight given above for infantry in fours, is their weight when crowded at a check to the utmost extent possible without losing their formation. Normally the weight of infantry in fours is not more than 150—200 lbs. per foot-run. Even adding 50 per cent. to this, it will be seen that the proportion of dead weight to traffic load now obtained is such that the upper member will remain in tension. In calculations where the actual strength of the structure is involved, that is to say in determining the maximum stresses in the cables, it is of course necessary to take into account the greatest load that can be imposed on the bridge, but in the present instance the result of such a maximum loading would be only a temporary loss of rigidity, and it is therefore permissible, for the purpose of stiffness alone, to take the weight of the traffic at a lower value. As a matter of fact, the traffic load would have to be about 240 lbs. per foot-run, before the tension

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in the upper member was changed to a compression, and then only near the piers.

If thought necessary, it would be possible to lash light spars to the upper members over the first two bays on either side, to take any compression that might occur. They would butt against the caps of the piers, and would be also secured to the bracing.

With longer spans, the dead weight of the structure per foot-run increases, and the possibility of this reversal of stress becomes less.

It may be pointed out that such a reversal would only occur when about one-quarter of the bridge was covered with traffic, the remainder being unoccupied; it is clear that such a condition would rarely be coincident with an extreme crowding of troops at a check.

It has been mentioned before that the constructional methods of field bridges do not allow of a reduction of area of member to meet varying stresses. That is to say for the present purpose it will be sufficient to consider the maximum possible stress in both the upper and lower members, and design the cables to meet the larger of these two, as it will be seen that the lower member of one semi-rib becomes the upper member of the other.

The maximum values of the horizontal components have already been considered, and thus it will be seen that the maximum direct tensions are as follows:—

Lower member—

$$(p+q)\,\frac{a^2}{16d}\sqrt{1+\left(\frac{6d}{a}\right)^2};$$

upper member—

$$\frac{a^2}{16d}\left\{p+q\,\left(1+\tfrac{1}{2}\right)\right\}\sqrt{1+\left(\frac{2d}{a}\right)^2},$$

giving m its maximum value of $\frac{a}{2}$.

Which of these two is the greater, depends on the proportion of p to q, and on the proportion of dip to span, though for usual values it will be found that the maximum tension in the upper member will be the greater, and will thus determine the size of the cables. As pointed out above, the value given to q in this calculation must be the maximum possible, as the strength of the structure is involved, and not merely its rigidity.

Turning to a consideration of the strength necessary in the diagonal bracing, it will be seen at once that some of the members are redundant, and that the stress in any panel will be divided between the two braces, one in tension, and one in compression, in an unknown proportion. The possibility of initial stresses must be also considered, and in consequence great care should be taken in the construction of the rib to avoid this.

It would not be safe to assume in calculating the dimensions of the

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diagonals, that the stress is equally divided between them, while on the other hand it would be extravagant to calculate the one in compression as taking all the stress. A satisfactory compromise would be to calculate them so that each should be able to bear the entire stress in tension.

It is shown by Mr. Claxton Fidler that the horizontal component of the maximum stress in any diagonal due to any distribution of the moving load is

$$\tfrac{1}{2}\left(\frac{qa^2}{16d}\right)\left(\frac{2b}{a+2b}\right)$$

where b is the breadth of the panel. The division by 2 is necessary, as the bridge is suspended from two cable girders, one on each side of the roadway.

To find the direct stress, this expression must be multiplied by the secant of the inclination of the diagonal to the horizontal. This inclination varies with each diagonal in every panel, but sufficient accuracy would be obtained by taking an average inclination ϕ, where ϕ is

$$\tan^{-1}\frac{d}{2b}.$$

The stresses can however be found graphically, more accurately and almost as quickly. If the scale for the stresses be so chosen that b, the panel breadth, represents the horizontal component, then the lengths of the various diagonals, to the same scale, will represent the direct stresses in them.

With a single system of bracing, the stress in each vertical would be the vertical component of the direct stress in the corresponding diagonal, but with the system of cross-bracing, they may be relieved of a large portion of this.

In determining their cross-sections, however, it is better to take into account the full stress, which can be found graphically with sufficient accuracy, from the length of the verticals, using the same scale for these stresses, as was used before. The verticals should be strong enough to bear this stress in compression.

The case of a concentrated weight, or a series of concentrated weights, crossing the bridge, will not be considered at any length. It is sufficient to say that the calculated safe strength of the cables will not be exceeded if the concentrated weight on any one bay does not exceed qb, q being the maximum value of the distributed traffic load, and rigidity will not be lost if the concentrated weight of each bay does not exceed $2pb$, where p is the dead weight of the structure per unit of length, and then only if coincident with the worst case of loading, that is to say, one-quarter of the span being covered, the remainder clear of traffic.

The thrust on the piers, the inclination of the cables from the piers

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to the anchorages, and the strength necessary in the anchorages, can all be calculated as though the rigid system were replaced by a single cable, hanging in the neutral parabola. It should be noted that the piers will require careful strutting and staying, to withstand the varying stresses due to a moving load.

The length of each cable of the rigid system can be taken with sufficient accuracy as that of a cable in the neutral parabola, the usual allowances being made for length required at the anchorages, and so forth.

The length of the slings can be found graphically or by calculation, in either case making the necessary allowances for the camber of the roadway, and the length of the shortest sling, noting however that in this type of bridge, the central sling will not be the shortest, but that there will be two shortest slings, real or imaginary, one from the vertex of each parabolic lower member, at a distance from the abutment on each side equal to $\frac{3}{8}$ of the span.

As a diagram will probably have to be drawn in any case to determine the stresses in the bracing, the graphical method will perhaps be the quicker way, and sufficiently accurate.

The other method is to make use of the equation derived from the mode of construction, which gives the length of each sling, measured from the horizontal tangent at the vertex of the neutral parabola, as

$$\frac{8d}{a^2}x^2 - \frac{2d}{a}x,$$

x being measured either way from the vertex of the neutral parabola.

The other calculations necessary, such as strength of slings, transoms, road-bearers, and anchorages, differ in no way from those required in the normal type, and will not be considered here.

No mention has been made of wind-bracing. It is obvious that the stiffness given by this construction is only in the vertical plane, and that lateral stiffness must be given by any of the usual methods, such as horizontal wind-ties, or horizontal girders. Sufficient lateral stiffness might perhaps be obtained by giving the bridge a "waist" in plan.

As an example, the necessary calculations, where they differ from those of the ordinary type, will be given for a bridge of 100′ span, 10′ bays, dip 1 8, to carry infantry in fours. This example is chosen as it is comparable with the bridge actually erected at Chatham, and for which certain data as to the labour required for its construction will be given subsequently. It has been already mentioned that a larger dip than usual can be used in this type of bridge without loss of rigidity.

The estimate already given for dead weight of structure will hold good, and p can thus be taken as 180. In calculating the strength of the cables, q must be taken as 840.

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Then maximum tension in lower members is

$$\frac{(180+840)\ 100^2}{16\times 12{\cdot}5}\sqrt{1+\left(\frac{75}{100}\right)^2}$$

$$=63{,}699 \text{ lbs.}$$

$$=29 \text{ tons nearly.}$$

And maximum tension in upper member is

$$\frac{100^2}{16\times 12{\cdot}5}\{180+840\times 1{\cdot}5\}\sqrt{1+\left(\frac{25}{100}\right)^2}$$

$$=74{,}088 \text{ lbs.}$$

$$=33 \text{ tons practically.}$$

This latter figure will therefore decide the size of the cables.

Each upper member will have to stand half of this or 16·5 tons, and taking the safe stress in steel wire rope as 9 C^2 cwt., the necessary size of rope is found to be 6″.

The maximum horizontal component of the stress in the diagonal bracing is

$$\frac{1}{2}\times\frac{840\times 100^2}{16\times 12{\cdot}5}\left(\frac{20}{100+20}\right)$$

$$=3{,}500 \text{ lbs.}$$

The direct stresses in the various diagonals and verticals can be best determined graphically. Referring to *Fig.* 5, and choosing a scale for the stresses, such that the length representing 10′, the breadth of the panel, shall also represent 3,500 lbs., it will be found that the direct stresses are as follows :—

Diagonals.

JN	...	...	...	...	3,714 lbs.
KM	...	...	...	...	4,183 ,,
MT	...	...	...	...	3,717 ,,
NS	...	...	...	...	4,599 ,,
SY	...	...	...	...	3,553 ,,
TX	...	...	...	...	4,592 ,,

Verticals.

JK	...	1,400 lbs.	Length	...	4′
MN	...	2,100 ,,	,,	...	6′
ST	...	2,100 ,,	,,	...	6′
XY	...	1,400 ,,	,,	...	4′

Using round spars of Baltic fir, and allowing 2,000 lbs. per square inch safe stress in tension, and 1,500 lbs. per square inch compression,

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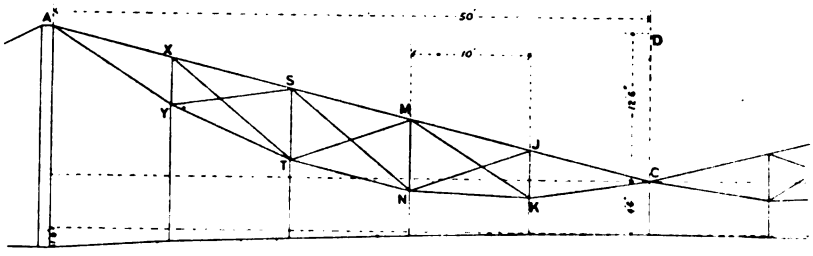

FIG. 5.

it will be seen that spars of 2" diameter will be suitable for all the diagonals, and that spars of 3" diameter will do for the verticals JK and XY, and of 4" diameter for MN and ST.

To calculate the length of the slings, their length from the horizontal line through C is given by the formula

$$y = \frac{8 \times 12{\cdot}5}{100^2} x^2 - \frac{2 \times 12{\cdot}5}{100} x,$$

and giving x the successive values of 40, 30, 20, and 10, these lengths are found to be

1st sling	+6′
2nd „	+1′ 6″
3rd „	−1′
4th „	−1′ 6″

To make the length of the shortest slings about 3′, an allowance of 4′ 6″ will have to be added to each of these values, and there is also the camber of the roadway to be allowed for. If the roadway has a parabolic camber, with a rise of 1/60 of the span at the centre, the allowances to be made are found from the formula

$$y = \frac{4 \times \frac{100}{60}}{100^2} x^2,$$

x being measured as before. Substituting the values of x, these allowances are found to be

1st sling...	+1′ $0\frac{3}{4}$″
2nd „	+ $7\frac{1}{4}$″
3rd „	+ $3\frac{1}{4}$″
4th „	+ $\frac{3}{4}$″

and the length of the slings is as set forth in the following table :—

Distance from Abutment.	Number of Sling.	Length to Horizontal through C.	Length of Central Sling.	Camber Allowance.	Total.
10′	1st	+6′	+4′ 6″	+1′ $0\frac{3}{4}$″	= 11′ $6\frac{3}{4}$″
20′	2nd	+1′ 6″	+4′ 6″	+ $7\frac{1}{4}$″	= 6′ $7\frac{1}{4}$″
30′	3rd	−1′	+4′ 6″	+ $3\frac{1}{4}$″	= 3′ $9\frac{1}{4}$″
40′	4th	−1′ 6″	+4′ 6″	+ $\frac{3}{4}$″	= 3′ $0\frac{3}{4}$″
50′	5th		+4′ 6″		= 4′ 6″

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The height of the piers is

$$12' 6'' + 4' 6'' + 1' 8'' = 18' 8''.$$

As a useful check on the accuracy of the calculations to determine the length of the slings, and the height of the piers, it may be noted that their extremities lie on curves of the second degree, and therefore, as they are at constant distance apart, their second differences must be equal, as follows :—

		1st Difference.	2nd Difference.
Piers ...	... 18′ 8″		
		+ 7′ 1¼″	
1st sling	... 11′ 6¾″		+ 2′ 1¾″
		+ 4′ 11½″	
2nd „	... 6′ 7¼″		+ 2′ 1½″
		+ 2′ 10″	
3rd „	... 3′ 9¼″		+ 2′ 1½″
		+ 8½″	
4th „	... 3′ 0¾″		+ 2′ 1¾″
		− 1′ 5¼″	
5th „	... 4′ 6″		

All the other calculations necessary can be worked out in the usual manner, and will not be gone into here.

As regards erection, this type of bridge does not differ materially from the ordinary kind, but a few points may be noted.

The parabolic semi-ribs, or cable girders, should be constructed on shore. For this purpose, a series of park pickets, or other stout pickets, should be driven into the ground to represent the various panel points, as shown in *Fig.* 6. Their positions are best found

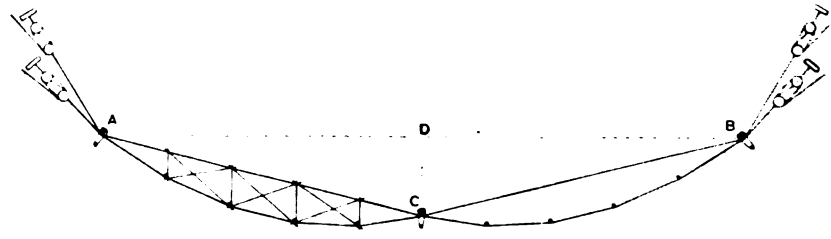

FIG. 6.

from a base line and ordinates, and the greatest care must be taken to lay out the girders as accurately as possible, to avoid initial stress in the diagonals, when they are placed in position in the bridge. It is especially necessary to ensure that the girders are made the same horizontal length as the distance between the piers. It is advisable to place a group of three pickets at each of the points representing A, B, and C, and also to stay them back to another picket, as a considerable amount of stress will come upon them in the process of

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taking the stretch out of the cables. This is done by securing a tackle to each end of each cable, as shown in the figure, differential tackle, if available, being very convenient. When the cables have been thus stretched in position, the diagonals and verticals are lashed to them very securely, endeavouring to make the various members meet as far as possible in the calculated panel points. It is more convenient, in the subsequent erection, if these spars project no more than is necessary beyond the cables.

The cables must be thoroughly fastened together where they cross, at the point C, as the rigidity of the structure, when the load is not uniformly distributed, depends on the cables not slipping here. Some form of bolted clip would appear to be desirable. It is best to make this joint and to secure it to the group of pickets at C, before applying the tackles to the free ends of the cables.

The points of attachment of the various slings should be marked with paint, in case the cross-bracing should get displaced, and the portions of the cables that are to rest on the piers should be similarly marked. For convenience in subsequent handling, the cables may be secured together at the points A and B.

When one cable girder has been completed, it is lifted off the framework, and the other one then made.

These girders are best put into position by being launched along a ropeway, stretched from a derrick on each bank, by securing slings to the upper panel points and attaching these slings to snatch-blocks travelling on the ropeway, care being taken to keep the girders in their proper shape, to avoid undue stresses in the bracing.

Each cable is taken separately round the anchorage, and secured in any of the usual ways, after being adjusted so that the portions marked are over the piers.

The following method of securing the cables was used in the Chatham bridge, and was found very convenient for making the final adjustments. Each cable was taken round the anchorage without a round turn, and secured by two bolted clips. The cables were pulled up a little above their final position, and when the bridge was completed, were adjusted with great accuracy, by loosening the clip further from the anchorage, passing an inch or so of the cable through it, and tightening it up again; the other clip was then loosened a little, thus allowing the slack in the cable to run through slowly, and then tightened again. This operation was repeated until the girders were adjusted.

The operation of placing the slings and transoms may perhaps be not quite so easy as in the ordinary type of suspension bridge, but no serious difficulty is experienced, especially as the majority of the slings are short; by building out the bridge bay by bay, they can be put on the cables and allowed to slip out to their positions, being automatically stopped by the bracing at the right place.

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Turning to a brief consideration of the labour required for the erection of this type of bridge, it must be at once admitted that more is required than in a similar bridge of the ordinary type. It may however be remarked, that time is usually the dominating factor, and not the number of men available, and all the extra operations, such as rigging the ropeway, making the cable girders, and so forth, can proceed independently of the other operations; thus the length of time required to erect a bridge of this description will be no more than that necessary for the ordinary kind, provided that the extra men are forthcoming.

In this connection the following labour data for the bridge erected at Chatham may be interesting.

The span of the bridge was 90′, the bays were 10′, and the dip was 1/10. It was designed to carry infantry in fours. The necessary timber was available in suitable scantlings, and hence no carpenter's labour was required, with the exception of framing the piers out of 12″ × 12″ baulks.

The total amount of labour required was 616 man-hours, approximately 7 man-hours per foot-run of bridge, a figure that compares favourably with the examples given in Part III. of *Military Engineering*.

The labour required was made up as follows :—

	Man-hours.
Making cable girders	58
Erecting ropeway	33
Anchorages	51
Framing and erecting piers	125
Launching cables and general work till completion ...	349
Total	616

It was found that an average party of about 25 men could be profitably employed, and therefore the bridge ought to be completed in about 24 hours. The total time actually taken was about 29 hours.

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GENERAL PRINCIPLES OF ORGANIZATION AND EQUIPMENT, ROYAL ENGINEERS.

(*Continued*).

Conditions of Service and Enlistment.

All recruits are sent to Chatham (except sappers for the Field Troops and drivers) to be approved and tested at the trades, and undergo the prescribed course of instruction in drill and military engineering. Sappers for the Field Troops and drivers are sent to Aldershot on enlistment for training.

Every sapper recruit for the Royal Engineers, with a few exceptions, must be a tradesman or artizan, of a trade authorized as useful for the Corps, and the *personnel* of the different units is made up of men of different kinds of trades proportioned according to the special requirements or duties of the unit.

Conditions of Enlistment.

The conditions of enlistment and terms of service are laid down in the Regulations for Recruiting.

Every man eligible for the R.A., R.E., or the Foot Guards, is, before enlistment, to be encouraged to join any of these which is open for recruiting in the district; and steps are taken to ascertain that this order has been complied with in each case before the recruit is finally approved.

The requirements as to age, height, chest measurement, and weight are as follows:—

Limits of age (with the exceptions specified below)	18 to 25 years.
Engine Drivers	18 to 30 years.
Military Mechanists	25 to 35 years.
Telegraph Reserve	19 to 30 years.

The regulated height, weight, and chest measurement are at present as follows:—

Height.

Sappers (except as specified below) ...	5′ 6″ and upwards.
Military Mechanists	5′ 7″ „
Bricklayers	5′ 5″ „
Shoemakers	„ „
Tailors	„ „
Telegraph Reserve	„ „
Drivers	5′ 5″ to 5′ 7″.
Sappers for Field Troops	„ „

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Weight and Chest Measurement.

SAPPERS AND DRIVERS.

Age.	Height.	Weight.	Chest Girth when fully expanded.	Range of Expansion not less than
	Inches.	Lbs.	Inches.	Inches.
18	62 and under 65	115	34½	2
	65 ,, 68	115	35	2
	68 ,, 72	118	35½	2
	72 and upwards.	122	36	2½
19	62 and under 65	115	35	2
	65 ,, 68	117	35	2
	68 ,, 70	120	35½	2
	70 ,, 72	124	36	2
	72 and upwards.	128	36½	2½
20	62 and under 65	115	35	2
	65 ,, 68	120	35	2
	68 ,, 70	123	35½	2
	70 ,, 72	126	36	2½
	72 and upwards.	130	36½	2½
21	62 and under 65	118	35	2
	65 ,, 68	121	35½	2
	68 ,, 70	124	36	2
	70 ,, 72	127	36½	2½
	72 and upwards.	132	37	2½
22 and over.	62 and under 65	120	35	2
	65 ,, 68	123	35½	2
	68 ,, 70	126	36	2
	70 ,, 72	130	36½	2½
	72 and upwards.	133	37	2½

The terms of service are as follows :—

	With the Colours.	In the Reserve.
Sappers	3 years.	9 years.
Sappers of certain trades as laid down in para. 9A, Appendix II., Recruiting Regulations	3 or 7 years.	9 or 5 years.
Drivers	2 years.	10 years.
Men enlisted for appointment as Military Mechanists	12 ,,	*Nil.*
*Telegraph Reserve	3 ,,	3 years.

* Recruits for the Telegraph Reserve will be transferred to the Reserve immediately on enlistment. During peace they will not be retained with the colours more than six months after the cessation of hostilities, and they will be liable to be discharged when they cease to be employed in the Post Office.

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SPECIAL QUALIFICATIONS.

(*a*). *Sappers and Drivers.*

(i.). Every recruit for the Royal Engineers must be able to read and write, and obtain a certificate of character (on Army Form B. 64) from his late employer.

Sappers must also obtain a certificate of trade proficiency (on Army Form B. 195) and sign a certificate as to engineer pay (on Army Form B. 151).

(ii.). A man of any of the following trades may be enlisted as a sapper (European) for the companies of the Corps :—

Balloonist.
Blacksmith.*
Boilermaker.
Bricklayer.*
Cabinet-maker.
Carpenter.*
Coppersmith.
Cooper.
Electrician.
Engine Driver.
Engine Erector.
Fitter.*
Gasfitter.
Harness-maker.*
Instrument Repairer.
Joiner.*
Mason.*
Metal Turner.
Moulder.
Painter.*
Paper-hanger.
Pattern-maker.
Plasterer.
Plumber.*
Rigger.
Rivetter.
Sawyer.
Slater.
Telegraphist { line. / office (see para. (*b*)).
Telephonist.
Tinsmith.
Wheelwright.*
Whitesmith.
Wood Turner.

(iii.). A man of the following minor trades may be enlisted as a sapper (European) for the companies of the Corps :—

Cable Jointer.§
Driller.§
Dynamo Attendant.§
Electric Bell Fitter.§
Fettler.§
Fireman or Stoker.§
Joiner's Helper.§
Machinist.§
Motor Fitter.§
Pavior.§
Plumber's Mate.§
Scaffolder.§
Striker or Hammerman.§
Switch-board Attendant.§
Tool Grinder.§
Wireman.§

(iv.). A man of any of the following trades may only be enlisted

* See para. (v.).

§ See para. (vi.).

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as a sapper (European) for the companies of the Corps after reference to the officer i c R.E. Records :—

Architect.§	Sailmaker (for training as Kitemaker).
Brennan-worker.	Shoemaker.§*
Clerk.*	Surveyor.
Draughtsman.	Tailor.§*
Lithographer.	Any other trade likely to be useful in the Corps.§
Photographer.	
Platelayer.	
Printer.	

(v.). Only men of the trades marked with an asterisk may be enlisted as "mounted" sappers for the Field Troops, after reference to the officer i c R.E. Records.

(vi.). A man of any of the trades marked § is not eligible for rates of engineer pay higher than the 6th (6d. a day), unless he qualifies by test after joining the Corps in one of the other trades enumerated in paragraphs (ii.) and (iv.).

(vii.). Men of the following trades, viz., blacksmiths, electricians, engine drivers, engine erectors, fitters, gasfitters, instrument repairers, metal turners, and any other men possessing educational qualifications approximating to those required for a second class certificate of education, may elect whether they will enlist for 3 or 7 years' colour service. Recruits should be informed that 7 years' men have preferential consideration in selection of men for coast defence training.

(viii.). A farrier or shoeing-smith may be enlisted either as a sapper for the Field Troops, or as a driver, and should be sent to Aldershot for training in mounted duties in view to subsequent employment as a shoeing and carriage smith in the field units of the Corps.

(ix.). Special care should be taken as regards the trade qualifications of a recruit, and only those should be enlisted who are reported to be at least "fair" tradesmen, if examined in a military workshop, or "good" if examined by a civilian tradesman. A sapper enlisted for the companies of the Corps is rated for engineer pay according to trade test after joining the Corps. Men of the trades enumerated in paragraph (ii.), whose trade qualifications are found after enlistment to be less than fair will, whenever possible, be classified as belonging to one of the minor trades enumerated in paragraph (iii.).

(x.). No man should, as a rule, be enlisted as a driver unless he is accustomed to the care and management of horses. A driver is classified as such for engineer pay.

(b). Telegraphists.

The name and address of any man desiring to enlist as an office telegraphist is to be sent by the recruiting officer to the O.C. 'K' Telegraph Company, R.E., Aldborough House, Dublin, who

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will cause him to be tested, and will furnish a certificate of his qualification, stating if he recommends the enlistment. If the certificate (which should be attached to the attestation) is satisfactory and the enlistment recommended, the recruit may be enlisted, provided he is up to the prescribed standard, but authority must first be obtained from the War Office. If recommended, although not up to the standard, an application for his special enlistment should be submitted.

(*c*). *Telephonists.*

A man who is able to read fluently and write correctly and rapidly from dictation, and who has been employed in the construction or maintenance of telegraph or telephone systems, may be enlisted as a telephonist with a view to going through a course of instruction to qualify in the special military requirements.

A man so enlisted must have a fair technical knowledge of the work on which he has been employed. Any man who has been merely employed as a labourer on construction work should not be accepted.

(*d*). *Military Mechanists.*

A limited number of men are enlisted, by special authority from the War Office, for appointment as military mechanists. The trades of men required will be notified when candidates are called for. Such men will not be required to sign the certificate as to engineer pay.

On enlistment as mechanists, men will at once be promoted mechanist staff-sergeants on probation, and generally be sent, in the first instance, to the School of Military Engineering, Chatham.

The period of probation will not exceed 12 months, and for the first three months—or such longer period as may be necessary—they will be placed under instruction in drill, etc.

Their appointment to the permanent establishment on completion of probation will be subject to their being considered duly qualified, and in possession of at least a 2nd class certificate of education.

A list of candidates for enlistment as mechanists is kept by the officer i/c R.E. Records.

Applications for names to be registered should be made to the Recruiting Officer or Commanding Royal Engineer of the District in which candidates reside.

All recommendations for registration, or enlistment, should be made on Army Form B 203, and accompanied by certificates of character, of past trade experience, and of present trade qualifications, as well as by certified specimens of writing from dictation and arithmetic; they will also be supplemented by any information which the officers nominating the men may be able to obtain concerning their general suitability.

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(*e*). *Telegraph Reserve.*

In addition to the telegraphists enlisted under ordinary conditions for the Royal Engineers, a limited number of post office telegraphists will also be enlisted by special authority, and at once passed to the Army Reserve.

They will be selected from the 8th Battalion City of London Regiment, and the consent of the Postmaster-General will be obtained before enlistment, on the form prescribed in the Recruiting Regulations.

(*f*). *Enlistment of Boys.*

Boys of good character, and between 14 and 16 years of age, may be enlisted for training as musicians, trumpeters, or buglers, according to proportions laid down in Recruiting Regulations. Boys from the Gordon Boys' Home who have been specially trained as musicians or in some trade may be enlisted up to 17 years of age.

The Royal Engineers are, in addition, allowed 30 boys between 15 and 15½ years of age for training as telegraphists, and 40 boys between 14 and 15½ years of age for training as tailors and shoemakers.

The boys, except those for training as trumpeters, must come up to the following standards :—

Age.	Height.	Chest Girth. When fully expanded.
14 to 14½ years	4′ 10″	28½″
14½ to 15 „	4′ 11½″	29½″
15 to 15½ „	5′ 1″	30½″

No special standard is fixed for trumpeters, each case being considered on its merits; but boys of smaller physique are usually accepted for this class.

Sons of deceased non-commissioned officers and men of the Corps may be specially considered as to physique.

For the R.E. the selection of boys rests with the officer i c R.E. Records, to whom application should be made in each case.

Applications for names to be registered should be made through the recruiting officer, or Commanding Royal Engineer of the sub-district in which the candidate resides.

Applications for names to be registered for training as buglers, tailors, shoemakers, and telegraphists will be forwarded to the officer i c R.E. Records, and for trumpeters to the O.C. Troops and Companies, R.E., Aldershot, for consideration, and will be accompanied by the following documents :—

Descriptive return on Army Form B. 203 (showing chest girth when fully expanded, and range of expansion in inches).

Certified specimens of handwriting from dictation, and arithmetic, and a certificate of the Army or Council School Standard that he has passed.

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Certificates of birth and good character.

The written consent of parents or guardians to the enlistment, stating the class for which the consent is given for the lad to enlist.

It should also be stated whether the candidate's father ever served in the Army, and, if so, his regimental number, rank, and regiment (or corps) should be given. Any subsequent advance in standard of education should be at once communicated, with a certificate, to the officer i/c R.E. Records. Any change of address should also be notified.

The earliest date at which boys' names are noted is 13 years, but no boy can be enlisted until he is 14 years of age.

MOBILIZATION.

The *Regulations for Mobilization* contain the detail and orders laid down for the whole Army under the following headings :—

PART I.

EXPLANATION OF TERMS USED.

PART II.

MOBILIZATION ARRANGEMENTS FOR ALL UNITS.

SECTION I.—GENERAL PRINCIPLES.

SECTION II.—PREPARATORY MEASURES—

- General instructions.
- Personnel.
- Animals.
- War outfit.

SECTION III.—PROCEDURE ON MOBILIZATION.

PART III.

REGULAR ARMY AND REGULAR RESERVISTS.

SECTION IV.—PREPARATORY MEASURES—

- General instructions.
- Personnel.
- Animals.
- War outfit.
- Documents.

SECTION V.—PROCEDURE ON MOBILIZATION—

- General instructions.
- Special instructions regarding units formed on mobilization.
- Reservists joining the colours.
- Duties of an officer i/c records.
- Duties of an O.C. a regimental depôt (or company R.A.M.C.).
- Duties of an O.C. a unit.
- Duties of an O.C. the details of a unit or units.

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SECTION VI.—SPECIAL INSTRUCTIONS AFFECTING THE PAY, ALLOWANCES, ETC., OF REGULAR RESERVISTS AND PENSIONERS ON MOBILIZATION—
Regular Reservists.
Pensioners.

PART IV.

SPECIAL RESERVE.

SECTION VII.—PREPARATORY MEASURES—
Personnel.
Animals.
War outfit.
Documents.
SECTION VIII.—PROCEDURE ON MOBILIZATION.

PART V.

TERRITORIAL FORCE.

SECTION IX.—PREPARATORY MEASURES—
Personnel.
Animals.
War outfit.
Documents.
SECTION X.—PROCEDURE ON MOBILIZATION.

NOTES.

Parts I. and II. of these regulations are generally applicable to all units which would mobilize at home, either for service abroad or for home defence.

Parts III., IV., and V. deal with procedure, not already provided for in Parts I. and II., which is specially applicable to the Regular Army and Regular Reserve, Special Reserve, and Territorial Force respectively.

Printed lists of the various equipments, showing the articles to be drawn by each unit, are issued to officers commanding, and are termed "Mobilization Store Tables."

These Tables serve as :—

(*a*). Record of war equipment of the unit.
(*b*). Storehouse label for mobilization equipment.
(*c*). Form on which to render return of mobilization equipment, as may be ordered.
(*d*). Voucher for issue of mobilization equipment.

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THE MONOCRETE MACHINE.

By LIEUT. D. McA. HOGG, R.E.

THIS machine is, I am aware, well known to a number of R.E. officers, but I think that a brief account might prove of interest. It is the invention of Mr. R. Bowen, to whom I am indebted for his kindness and courtesy in supplying me with information on the subject.

The machine builds, in a few minutes and in a single operation, a section of wall in concrete which is equivalent, in ordinary masonry, to from 72 to 450 bricks, according to the thickness of wall, etc.

The foundations of the building are first laid in ordinary masonry of any kind, and it is on this that the "Monocrete" machine is set to work. The machine itself is made of magnalium, an alloy of magnesium and aluminium—tougher than the latter and equally rust proof, though subject continually to the dampness of the concrete which it moulds into wall work.

METHOD OF USING THE MONOCRETE MACHINE.

The machine is laid and aligned on the masonry foundation. Thus set up, it forms a box or mould without top or bottom, one end being permanently closed when in use, and the other being closed by a clip-tie and board (*Fig.* 1) while the sides are hinged vertically at

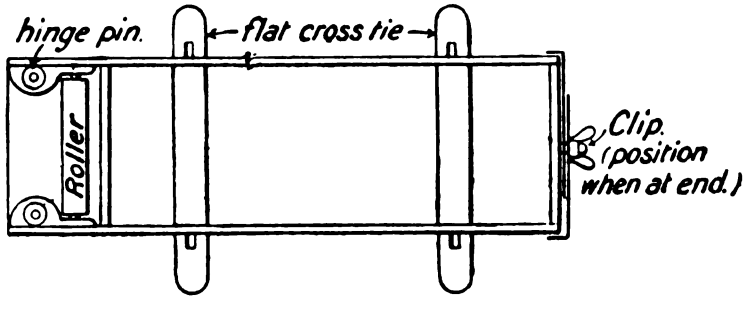

FIG. 1.—*Top View of the Machine.*

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one end. It will be seen that this "board" is only required for the construction of the first section of a course, being removed for succeeding sections. *Fig.* 2 shows the end elevation of the Monocrete

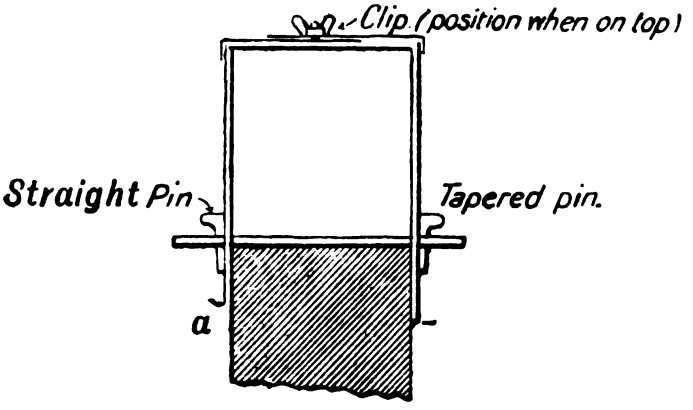

FIG. 2.—*End View of the Machine.*

machine with the lower portions of the sides gripping the course below, and thereby keeping the wall vertical. Seen from the top, the machine presents the appearance of an oblong trough, the sides being hung on hinges beyond the box portion.

Into this box, concrete in a semi-wet condition is shovelled. It is well rammed and made true on top, the clip and side wedges are removed, the sides are swung out on their hinges, and the machine is immediately rolled along to the next section, leaving a completed section of concrete wall behind it. The "board" referred to above is now removed and is not required for the rest of this course. Again the machine is filled with concrete, rammed down, and the operation repeated.

An essential feature of the operation of the machine is the consistency of the concrete with which it is filled. It has only from 10 to 12 per cent. of water, a proportion amply sufficient to ensure perfect crystallization of the cement, so that the mould can be removed directly the concrete has been well rammed, leaving it to set naturally. There is no work of mortaring the interstices between one block and the next, as there are none; for the blocks being constructed in contact while green, and layer upon layer, the whole wall forms a monolith. On the top of the layer which it built up on its last journey, the machine starts another journey, raising up a further course of concrete in perfect cohesion with the one below.

The machine works so evenly and exactly that the use of a plumb

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line is unnecessary up to at least 20′ in height, though of course one can and should be applied occasionally for verification.

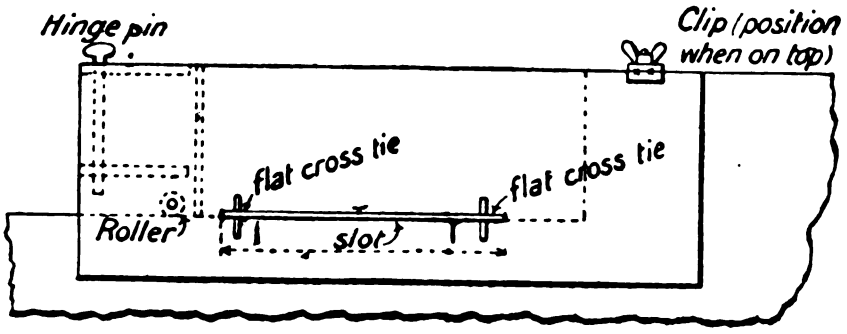

Fig. 3.

By a simple contrivance a corner can be turned, so that the machine can be worked round a structure, or can be made to construct chimney breasts, front door return walls, and even bay windows.

By the use of moulds, mouldings for cornices, cores, centering, etc.—any one of which is merely placed in the machine where wanted—window and door spaces and reveals, recesses, circular flues, sockets for beams and joists, arches, etc., can be made without any extra expense.

The placing of metal core boxes in the mould forms whatever cavities or places for resting joists are required. The metal surfaces of the machine give a sufficiently smooth surface to the concrete which thus requires no finishing by hand; though as the concrete is still fairly soft when the machine passes on, it is easy to mark imitation joints upon each layer, or to scrabble its face, or to dash pebbles upon it to make it rough cast.

Internally, the walls are smooth enough to leave without plastering in cheaper houses.

With material ready mixed and a staff of two unskilled labourers under the supervision of a man with a general knowledge of the building trade, a Monocrete machine erects wall work equal to at least 2,500 to 3,500 bricks, at a cost in labour of five shillings per 1,000 bricks. In practice the working of the machine can be left to ordinary unskilled labour after a very few hours' instruction and supervision. The machine is adjustable and can build walls from $4\frac{1}{2}''$ to 18″ in thickness. The length of the section or the depth of a course can also be varied.

Various adaptations of this machine have been designed for special purposes, but this appears to be the one of most interest to R.E. officers.

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The saving in the cost of buildings, etc., is enormous. The advantages of this system over the old system of concrete work, involving the use and setting up of shuttering, finishing of surface, etc., require no emphasis.

Note.—Practice, of course, varies immensely but the following proportion and sizes of aggregate have been found to work very well :—

3 parts by measure of crushed material or gravel $\frac{5}{8}''$ to dust.
3 parts of clean sharp sand.
1 part of best Portland cement.

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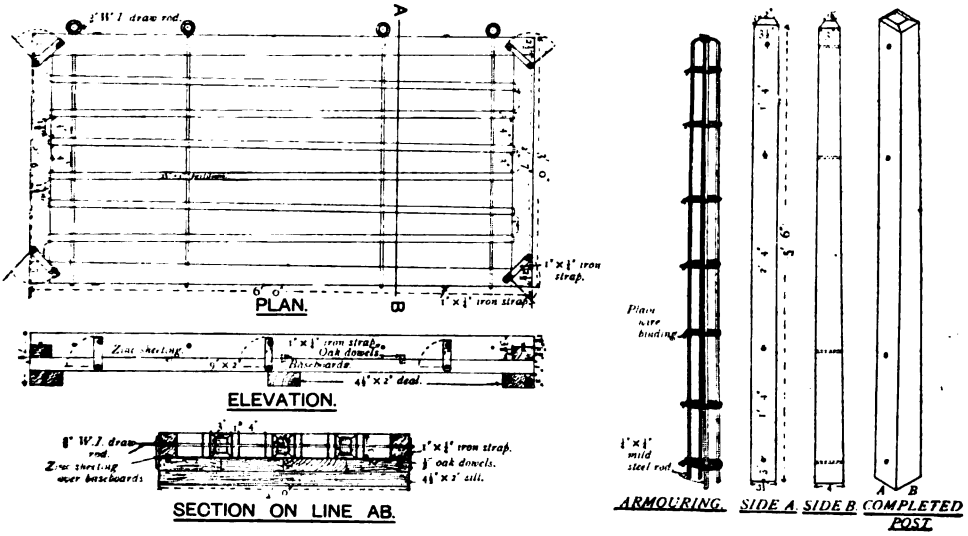
REINFORCED CONCRETE versus WOOD OR IRON.

By MAJOR H. E. G. CLAYTON, R.E.

REFERRING to Major Riach's article in *R.E. Journal* for February, 1909, the following notes in connection with the construction and fixing of reinforced concrete posts for wire entanglement may be useful.

The accompanying plan illustrates the posts of which 660 were made, and the moulds in which they were cast. One mason and 1 labourer could make 28 posts in 1 day.



The constituents of the concrete were :—

½″ granite siftings	...	...	...	2 parts.
Granite dust	...	...	...	1 part.
Cement ...	...	...	...	1 ,,

The reinforcing consisted of about 5 lbs. of ¼″ × ¼″ mild steel rod, and binding wire, constructed as shown on plan, and fixed at least ½″ from surfaces of posts.

A few posts were tested for cross breaking by placing them on supports 4′ apart, and piling iron on the centre (1′ bearing). A

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weight of 600 lbs. would not bend a post $\frac{1}{16}$th of an inch, nor produce any sign of cracking. 736 lbs. caused a post to sag $\frac{3}{16}$ths of an inch, and produced minute cracks on under side. Two men bearing heavily on the weights fractured the concrete, and slightly drew the iron rods on one side.

The posts were allowed 3 days to set in the mould, and 21 days to harden when stacked. The weight of a post, when completed, averages 69 lbs., and the cost of material for each post may be taken as follows:—

Mild steel (A.O.D. supply)			4¼d.
Cement (⅛th bushel at 2s. 8d. delivered) ...			4d.
Granite siftings / Granite dust (¼⅛th Y.C. at 1s.)			¼d.
Binding wire, 10′ run (A.O.D. supply)			½d.
			9d.
Labour per post			7·8d.
*Fixing in position		1s.	1d.
Concrete surrounding foot of post (2′ cube) ...			8d.
(Say 3s. 2d.).		3s.	1·8d.

Posts were fixed 1′ 6″ in the ground, and projected 4′.

	£	s.	d.
The amount expended, 2s. 9d. per post (including A.O.D. material)... £90 15 0			
Constructing moulds, erecting sheds, surplus material, casual labour in removing material from boat to store, etc. 20 18 9			
	111	13	9
Value of materials obtained from A.O.D.	10	4	8
Transport (land)	8	9	3
	£130	7	8

It should be noted that mild steel as issued by A.O.D. will not grip the concrete unless the metal has been heated sufficiently to remove the preservative with which it is covered. This increases the cost considerably.

The station at which these posts were made is one at which granite siftings are obtainable at a very cheap rate.

* This item was very heavy in consequence of the labour entailed in cutting away rock.

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THE FYERS FAMILY.

(Continued).

By Col. Robt. H. Vetch, c.b., late R.E.

Major-General Sir William Reid, R.E., G.C.M.G., K.C.B., F.R.S.

(Continued).

After the fall of Badajos Wellington prepared to assume the offensive. Lieut.-Colonel Burgoyne writing on the 23rd May, 1812, says: "Sir Rowland Hill has taken the *tête de pont* of Almarez by assault, made 300 prisoners and killed 200 of the enemy. Wright of ours said to be wounded slightly. We also just learn that poor Squire* died suddenly of a paralytic stroke at Truxillo; thus we have lost, in my mind, the best officer of the Corps, and a man who, I believe, never had an enemy." Certainly Reid lost a most sincere friend by the death of Squire, who, as we have seen, had done his best to promote the strong and just claims of his young comrade.

The surprise of Almarez was Wellington's first move in a deeply-considered plan. He had resolved that his best course was to attack Marmont's Army in the north and the first step was to isolate Marmont and this was effectually done by the destruction of the bridge and defences at Almarez which, for a time at any rate, prevented the armies north and south of the Tagus from combining their movements. In June, 1812, he pushed forward to Salamanca, where the enemy held important depôts of ammunition, clothes, and other stores, and laid siege to the forts constructed for their protection, and to command the passage of the Tormes River. The army crossed the Tormes early on the 17th June by the ford of Santa Martha, 1 mile above the city, and by that of El Canto, 4 miles below it. The 6th Division (to which Reid was attached), under Major-General Henry Clinton, immediately invested the French works and the rest of the army was placed in position to cover the attack, on the heights of Christoval, 3 miles in advance and to the north of the town.

A reconnaissance of the works was at once made from the

* Lieut.-Colonel John Squire, R.E., died at Truxillo on the 19th May, 1812.

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Cathedral and other high buildings, when it was found that instead of being, as was supposed, a few convents put into a state of defence, they were far more respectable for their purpose. It was said that no less than 13 convents and 22 colleges had been razed. The larger convent buildings alone were retained to act as interior retrenchments to the provisional fortifications erected. The works consisted of a fort on the north-west of the city, formed out of the large convent of San Vincente, standing in the centre of an angle of the old town wall, which is there very lofty, and built on a perpendicular cliff overhanging the river. There were lines of works with masonry scarps and counterscarps loopholed. A deep ravine separated Fort San Vincente from Forts Gayetano and La Merced to the south. These were also on high ground, and possessed good bombproofs and deep ditches with perpendicular scarps and counterscarps.

The only officers of the Royal Engineers employed at this siege were Lieut.-Colonel Burgoyne and Lieuts. Pitts and Reid. Want of artillery ammunition and of engineer siege equipment made it necessary that the attack should be of the simplest nature. It was decided to attempt to breach the wall of San Vincente. Sir John Burgoyne in his journal, under date 17th June, 1812, says: "The battery, with its communication, was commenced at night by a working party of 400 men. Being full moon the work was soon discovered by the enemy, and a fire of musketry directed on it. The nights were very short, and the ruins rendered it impracticable to excavate inside or out. The 6th Division had not been employed in the previous sieges, and great difficulty was found in keeping them to work under this fire; the Portuguese, in particular, absolutely went on their hands and knees and dragged their baskets along the ground. It was impossible much work could be done under such circumstances; the battery by daylight was not quite to the height of the *genouillère*.

"The ditch presenting a considerable obstacle, Lieut. Reid with four miners of the Line, and 20 men of the covering party, made an attempt at night to blow up a part of the counterscarp opposite the end wall of the convent proposed to be breached. The glacis there not being complete, it appeared that the miners might work under cover. The enemy had a picket outside, and a dog with them gave the alarm on the approach of our party. The picket was driven in after some little opposition, and the miners set to work; but the soil being loose, and difficult to sink in, and the spot exposed to plunging fire from the convent loopholes, after losing several men, the party was withdrawn, the object under the circumstances being impracticable. It had the effect, however, of engaging the attention of the enemy very much from the working party at the battery."

Fire was opened from two batteries on the 19th and continued on

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the following day, when Marshal Marmont with 15,000 men approached close to the position of the British Army at Christoval. At the same time ammunition for the guns was falling short and the attack on the forts was suspended. On the night of the 22nd a third battery was thrown up to breach Fort Gayetano. The French Army retired during that night followed by our cavalry. At 4 p.m. on the 23rd Wellington heard that one of the enemy's columns had crossed the Tormes 12 miles above Salamanca, and sending two divisions to the ford of San Martha, went himself to the camp to counteract any movement Marshal Marmont might make to succour the forts, or to draw off the garrison. The third battery opened fire at 11 a.m. on 23rd on the gorge of Gayetano with the ammunition that was left, and it was decided to attempt to carry Gayetano and La Merced by escalade at night. Reid led the ladder party. The garrison made a most determined resistance. Two ladders only were reared against Gayetano, no one got in, and the storming party returned with the loss of 120 killed and wounded.

While the French and British forces were manœuvring and fighting round the place, the siege works were continued and on the 26th a supply of ammunition arrived from Almeida. At 3 p.m. fire was opened and hot shot was fired at San Vincente, and continued through the night. At daybreak the fire was accelerated. A tremendous blaze broke out in the roof of the convent, and the whole building was soon in flames. At 10 a.m. the troops were formed in the trenches in the ravine for the assault of Fort Gayetano when a white flag was displayed, and the commanding officer proposed to surrender it and La Merced in two hours. The Commandant of San Vincente also sent out a flag of truce and offered to surrender in three hours. Wellington gave each of them five minutes to yield, in which case they would march out with the honours of war and save their baggage. At the expiration of that time the fire of our batteries was renewed and shortly after the works were carried by the British with little resistance.

Reid was mentioned in the General Orders of the 6th Division by Major-General (afterwards Sir) Henry Clinton in the following terms :—"The zeal and conspicuously gallant conduct of Lieut. Reid of the Royal Engineers has not escaped the particular attention of the Major-General; and he trusts that they will be duly appreciated by the Commander of the Forces." Reid was accordingly mentioned by Wellington in his despatch on the capture of the Salamanca forts.

Lieut. Pitts wrote :—

"The convent was on fire in several places; at 11 the Commandant of Gayetano offered to surrender both Gayetano and Merced in two hours. I happened to meet Lord Wellington first and told him. He

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ordered me back and said '*five minutes.*' The Frenchman was stiff and would have his two hours. My Lord would not flinch from his five minutes, and after a third parley the Frenchman said he would stand the assault. In the meantime the Governor of San Vincente offered to capitulate. Lord W. ordered the troops to move to the assault of Gayetano, which was carried with scarcely any opposition, and the garrison lost their baggage and everything except the clothes on their backs. Thus ended our siege. We should have had the place on the fourth, or at most on the fifth day, if we had had ammunition, and this would have been very quick, but, as it is, to men who understand our *Shop*, I am certain we deserve a great deal of credit. Our batteries were made with large flour sacks, scarce movable, and into the bottom of our parapets we put beds got out of the French hospital. The unwieldiness of such articles under a heavy fire of musketry and grape, with soldiers who had never been in action, without a sapper, and only two officers of Engineers for detail duties, are difficulties which would make a Vauban stare. To make our platforms we had two saws, and scarce a spike, and these platforms made of rough joists of all sizes and dimensions, but our greatest difficulty was in the embrasures.

"I see Reid is 'mentioned' in Lord W.'s despatch for his conduct with the storming party on the night of the 23rd, and fully deserved it. Burgoyne, in his report about the siege, says: 'Both were equally desirous to lead the storming party, but Pitts being the senior officer I designed him to lead that against San Vincente, which it was expected would take place, and Reid took the lesser one.' There was another reason which alone could have induced me to have allowed Reid the first opportunity. Reid is very low down and has distinguished himself on *several occasions*. Applications have been made to obtain for him the rank of captain. This will add weight to the former ones, and if he gets it, it *lays open* the same opportunity *to others*. I could not possibly expect it for once being 'mentioned,' when it has been so very much objected to for others who had more claims, besides I *must* have the rank shortly and the good luck a step would do me would be very trifling, whereas to him it was everything. Burgoyne could not make this public."

The capture of the Salamanca forts on the 27th June was followed by three weeks of manœuvring and some fighting, in which Marshal Marmont had the advantage. Wellington consequently found himself in a critical situation. General Chauvel with 2,000 French cavalry was within two days' march on the north. The French Army of the Centre was rapidly approaching to join hands with Marmont from the south. Secure of his southern communications Marmont had spread himself across the Tormes and interposed between the allied army and the road to Madrid, while his left wing could be extended to threaten the British communications with Ciudad Rodrigo.

On the morning of the 22nd July the left of the allied army rested on the left bank of the Tormes, near the ford of Santa Marta, and its

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front extended in a line at right angles to the river towards the village of Arapile and its two hills.

The position of the French was covered by a wood and embraced the heights of La Peña and the hamlets of Ariba and Abaxo. Early in the day the French seized one of the Arapile hills and the allied army the other and Wellington extended his line to his right.

The three officers of Royal Engineers employed at the Siege of the Salamanca Forts had been directed to rejoin the field army. Lieut.-Colonel J. Burgoyne and Lieut. Reid were attached to the 3rd Division, while Lieut. Pitts was extra aide-de-camp to Lieut.-General Cole, commanding the 4th Division.

The morning passed in a series of manœuvres on the part of Marmont. About 2 p.m. under cover of a heavy cannonade and a skirmish along the whole front of his line Marmont advanced his centre, and made a movement to his left to cut off the allied army from the Ciudad Rodrigo road.

This was the critical moment seized by Wellington. He saw the Thomière Division with light cavalry and 50 guns moving to its left towards Miranda and leaving an increasing interval between the French centre and its left. "At last I have them!" was Wellington's exclamation as he took the spyglass from his eye. Then turning to the Spanish General Alava, who stood near him, he said: "Mon cher Alava, Marmont est perdu."

The 3rd Division under Major-General the Hon. Edward Pakenham (General Picton being sick) was ordered to stand to arms. A strong body of cavalry was brought from the left to the right, and the line of columns was itself re-formed so that its left was on the Arapille village instead of its right. While these dispositions were being carried out Wellington sat down on the grass beside his brother-in-law and took a hasty repast. This ended he sprang to his feet and is reported to have said: "Do you see those fellows on the hill, Pakenham? Throw your division at them directly and drive them to the devil."

Burgoyne who, with Reid, was attached to Pakenham's Division describes what then took place:—"The conduct of my old friends, the 3rd Division, was most conspicuous. Supported by a body of our cavalry they made a tremendous rush and overwhelmed everything before them." No sooner had the 3rd Division crowned the heights on the extreme left of the French, than Pakenham formed line across the enemy's flank, and supported by cavalry advanced towards the centre pushing the enemy before him. The whole left wing of the enemy was soon in retreat and above 3,000 prisoners were taken.

The tide of success had not flowed so rapidly with the centre. Lieut.-General Cole had been wounded and his division compelled

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to retire, until the 5th Division came to its assistance and together they gained possession of the crest of the position. The French Arapile Hill had resisted repeated attempts to capture it, but was at last carried by Clinton. Marshal Marmont was wounded and the command of the French Army devolved upon General Clausel. He endeavoured unsuccessfully to retrieve the position of affairs, but was compelled to retreat, pursued by the cavalry of the allied army until nightfall.

The immediate result of this brilliant victory was the capture of 11 guns, 2 eagles and 7,000 prisoners; three French generals were killed and three others wounded. The total loss of the enemy cannot be put at less than 14,000 men. On the other hand the victors lost 5,000 killed and wounded including one general killed and five others wounded. But the result of most import was that it changed the whole aspect of affairs throughout the Peninsula; Soult relaxed his hold on Andalusia and concentrated in Grenada; the Siege of Cadiz was raised; Seville was carried by assault; and the enemy having withdrawn from Estramadura General Hill's force was no longer tied to the Guadiana but could co-operate with the main army.

Our three Engineers accompanied the Marquess of Wellington (as Salamanca had made him) on his march to Valladolid, which he occupied; and afterwards on his march to Madrid. This was successfully accomplished, after a sharp affair in crossing the Guaduramma Mountains. The capital was entered on the 12th August without opposition on the part of the French, and with demonstrations of joy and welcome from the Spaniards. But Joseph Buonaparte had left a garrison of nearly 2,000 men in the spacious entrenched post on the heights of the Retiro Palace which still held out.

Lieut. Pitts writes: "The people were half mad with joy, and it was as much as we could do to get through the streets. Being the first that entered we got the brunt. They preceded us with boughs of trees, and in crowds, and made so much noise we could not hear the trampling of our horses."

Burgoyne says in his journal: "Learning from the Spaniards that there is a garrison in the Retiro to protect their sick only, Lord Wellington sent me on with six dragoons to summon the place. They fired repeatedly at me, when I attempted to go in on the side of the town, from the walls of the Retiro Park, which they occupy, but on the country side they let me in. The Governor was hurt at a verbal message being sent them and answered, 'Les Français ne se rendent pas si facilement.'

"*August 13th.*—Reconnoitre the Retiro early, and afterwards with Lord Wellington. The principal post is the large, strong, square building, called La China, on the summit of the hill, formerly a china manufactory; round this they have a large star fort with a ditch

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12′ deep and 24′ wide, palisaded but without revetment; round this is an extensive complete line of fieldwork of a similar nature of ten fronts with bastions, and within three of the bastions are buildings—one of them the Observatory, strong and commanding. . . . Round this again they occupy the park wall and buildings skirting the Prado with flêches to flank the wall; this is of course very extensive. Lord Wellington orders them to be driven from this outer line of wall at night."

This was done and an extract from the journal of Lieut. Pitts gives the sequel in less detail than Burgoyne does:—

"*August 14th.*—Preparations were made to storm the interior retrenchment into which the enemy had retired. Our posts were within 100 yards of him. It was intended to carry this retrenchment by storm, and shut the enemy within the star fort, to make use of the ditches and parapets of the retrenchment as cover, to erect a battery against the building and set it on fire with hot shot, or breach it. This would have succeeded, I think without a doubt, and we might have had the whole on the 16th. Fortunately for everyone but the Engineers, the Governor chose to surrender. Three officers of Engineers and 70 sappers are caught. Reid was with the party on the French hospital side on the 13th, and I with the one in the Plaza de Toros Gate, where we penetrated on the flanks. The enemy retired from the buildings in no small hurry, the Governor leaving his supper on the table. The three of us (Burgoyne, Reid, and himself) have taken up our quarters in the house of the Duchess of Willahamina, and are living in rooms ten times too big for us."

Reid did not long remain in these sumptuous quarters in Madrid for Wellington decided to return to the north, where the French Army beaten at Salamanca had again begun hostilities, had occupied Valladolid and had compelled General Paget's force to cross the Douro. Leaving two divisions in Madrid he ordered four divisions to assemble at Arrevalo and on the 1st September left Madrid for that place. On the 7th the French were driven out of Valladolid and being forced back on Burgos, they retired to Briviesca, leaving a garrison of over 2,000 men in the castle of Burgos. On the 19th September the allied army entered Burgos and the castle was at once invested.

The castle and its outworks enclosed a rugged hill between which and the river stood the city. On the adjacent hill of San Michael was a large hornwork, under fire from the castle, and well flanked by its defences. It was also covered in front by entrenchments. The castle itself was well placed to protect the bridges and roads of approach and it had a triple defence of enceintes.

The British artillery was deficient in guns and ammunition. The Engineers were reduced to too small a *personnel*. Lieut.-Colonel

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Burgoyne was Commanding Royal Engineer and he had under him Lieut.-Colonel John Jones, Capt. Williams and Lieuts. Pitts and Reid. Ten officers of the Line were called upon to do duty as Assistant Engineers.

Operations began with the assault of the hornwork on the night of the 19th September. Lieut. Pitts led the ladder party and the work was captured, but with a heavy loss of 6 officers and 65 men killed and 15 officers and 334 men wounded. A lodgment was speedily formed and the captured guns were turned on the castle. Unfortunately the gallant leader of the assault, Lieut. Pitts, on returning from the trenches after the capture of the hornwork was thrown from his horse and had his arm broken.

In order to shorten the attack Wellington directed an attempt to be made to carry the outer enceinte of the castle by escalade. This assault was made on the night of the 22nd September and Lieut. Reid led the ladder party. The ladders were fixed and some gallant attempts were made to ascend them without success. The Portuguese battalion ordered to co-operate failed to comply with their orders, and the storming party had to retire with great loss. It now became necessary to resort to the original project of mining and blowing in the escarp. In the construction of the flying sap Capt. Williams, R.E., was shot through the heart on the night of the 24th and Lieut. Pitts in spite of his broken arm had to return to duty in the trenches. Reid was seized with illness, so that when the mine was ready there was no Engineer officer to lead the stormers at the assault which was made on the night of the 29th September. The assault, after the explosion of the mine, failed because the stormers were led to the wrong place.

"This," says Sir John Jones, "was the first assaulting party of a breach, which advanced from the trenches in Spain, unattended by an officer of Engineers, and it was occasioned by there never having been more than four Engineers present; one had already been killed, one had his arm broken, a third was sick, and it was wished to preserve the other (himself) for the daily duty in the trenches."

Jones himself, on the 4th October, at the third assault, was severely wounded by a musket ball in his ankle; but he was able to fire the mine. A breach was formed and was successfully stormed. A lodgment was then formed. The brave garrison continued to sally forth from time to time and to inflict punishment upon their assailants and to destroy their works. Every attempt to take the castle failed, and on the 20th October the advance of the French Army compelled Wellington to raise the siege. He expressly stated in his despatch to Earl Bathurst, dated Cabezon, 26th October, 1812, that the failure of success was not to be attributed to the Artillery and Engineers.

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Lieut. Pitts writes of this siege :—

"Returning home from the trenches the first night" (*i.e.*, the 19th September, after the capture of the hornwork at which he had led the ladder party), "my horse fell with me and I broke the small bone of the right arm close to the wrist, which laid me up till the morning of the 25th September, when I took Williams's duty, he being killed. Colonel Jones was shot through the ankle, and a severe wound it is; but the leg is doing well, and the fears entertained for him are from the very reduced state of body he is in. Reid was taken ill, and did little duty after 1st October, so Burgoyne and myself were the only remaining *real* Engineers, as a soldier called us, to distinguish us from the Assistants. Burgoyne got a lick in the head from a spent musket ball, from which he recovered in a few hours, and has the honour of his clothes being pierced.

"The failure of this extraordinary siege is certainly in the main to be attributed to the want of sufficient artillery, and also to the want of Sappers and Miners. Had we had the first, as it was, we should have taken the place; but we should have been greatly assisted by having good Sappers and Miners. They would have worked more scientifically and with more rapidity than the men we had, who were chiefly from the Guards They behaved very well but experience was wanting. From want of a sufficient number of officers of Engineers we had many Assistant Engineers; but these, though their conduct deserves every praise, are very lame substitutes for our own officers."

Wellington was at this time again in a difficult position, from which he extricated himself with his usual skill. The French armies of the south and centre, under Marshals Soult and Jourdan respectively, had effected a junction and were approaching Madrid, while the Army of the North under Souham was in force close beside him. Ordering Sir Rowland Hill to move towards Salamanca and evacuate Madrid, he himself retired to his old position on the heights of Christoval in front of Salamanca. On the 10th November the three French armies joined hands on the Tormes. Confronted by a force more than double his strength Wellington fell back on the Agueda, making a very clever retreat, closely pursued by Soult. But the season of the year no longer admitted of military movements. At the end of November the enemy withdrew and the allied army went into winter quarters. The divisions were distributed in cantonments between the Agueda and Coa Rivers. I have been unable to discover where Reid was quartered when he recovered from his illness, but he was probably with the 3rd Division through the winter.

Sir Richard Fletcher seized the opportunity of the lull in warlike operations to go to England on leave of absence, and Burgoyne took advantage of this to draft a letter to the Master-General of the Ordnance on the subject of the claims of Lieuts. Reid and Wright, R.E.,

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to promotion for their distinguished services ; this Sir Richard accepted and undertook to press with all his influence. At whatever "rascally place" Reid was stationed he must have been gratified to receive there from Burgoyne the following letter telling him what he had done on his behalf :—

From Lieut.-Colonel (afterwards Field Marshal Sir) John Burgoyne, R.E., to Lieut. W. Reid, R.E.

"MALHADA SORDA, *9th December*, 1812.

"DEAR REID,

"I am very sorry to hear that you are fixed to that rascally place ; there seems to be a probability that Henderson will join you, but *my* fate is not yet settled. Sir Richard is gone this morning and Goldfinch is coming up, but notwithstanding my respect and friendship for him I think it a duty I owe to officers who may at future times be placed in similar situations, to state to Lord Wellington what I conceive to be my fair claim to the command of the Department in this country, which I found on the German officers being of a different corps though of the same species, in like manner as a German and British regiment of the Line, and on account of three Portuguese majors now employed on the Lines and reporting to the Commanding Engineer.

"I shall state my case by letter as a fairer way towards Goldfinch to whom I can show a copy of it.

"Sir Richard takes home a letter I wrote on your business, which he promises to present and support to the utmost of his power. It is addressed to Lord Mulgrave and runs thus :—

"'MY LORD,

"'I beg leave to recommend Lieut. Reid and Lieut. Wright, two officers of Royal Engineers with the army under the Marquis of Wellington, to your lordship's notice for their brilliant services during the late campaigns.

"'Lieut. Reid has been present at the whole of the six sieges[o] in Spain, and was at all of them conspicuous for his spirited exertions and good conduct, even to the extent to be taken notice of by his superior officers not of the Corps of Engineers, particularly by Lieut.-Colonel Harcourt, 40th Regiment, in a letter which he wrote to the late Lieut.-Colonel Squire expressly for that purpose, on the occasion of a sortie made by the enemy during the first Siege of Badajos, and more particularly in the handsome and flattering paragraph in the Orders given out by Major-General Clinton after the Siege of the Forts of Salamanca which is as follows:—"The zeal and conspicuous gallant conduct of Lieut. Reid, etc., etc."

"'Lieut. Reid has been twice wounded, and has conducted and been foremost to various assaults for some of which officers of the Line have been promoted.

[o] The six sieges were first, second and third Sieges of Badajos, the Sieges of Cuidad Rodrigo, the Salamanca Forts, and Burgos.

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"'During the other services in which he has been engaged he has met with the particular attention and approbation of the two generals under whose immediate command he was stationed, namely, Don Carlos d'España and the Hon. Major-General Pakenham.

"'Lieut. Wright (then follows his story). . . .

"'The honourable desire and ambitions of these officers is promotion to the rank of Captain, which, as a testimonial of good services, for it would be of doubtful other advantage to them, I do most earnestly recommend your lordship's kind interference to obtain for them.

"'I have, etc., etc.'

"I hope I have omitted nothing in your case that ought to be mentioned.

"I also made out a Memorial from him recommending and pointing out the claim of the officers on active service to an increased allowance. It is too long to transcribe.

"Goldfinch I imagine will be up to-morrow.

"Yours truly,

"J. F. Burgoyne."

When the spring of 1813 arrived Lieut.-Colonel Sir Richard Fletcher returned from England to resume his duties as Commanding Royal Engineer of the army in the Peninsula, but he brought no good news for Lieuts. Reid and Wright. The authorities would not do anything in the matter of their promotion. Reid began to feel the continued injustice done him rather keenly. When so many of his senior officers thought he should be given a brevet captaincy, that the authorities should decline on the ground of want of precedent to do anything to show their approval of his conduct, was to a mind like Reid's very difficult to comprehend. But he remembered that his promotion by seniority must come within two or three years at the longest, and that it would be probably followed by a brevet majority. He called to mind the good advice so kindly given him by his friend, the late Lieut.-Colonel John Squire, and determined to go on doing his best and, if possible, to win fresh laurels in the forthcoming campaign.

During the long interval of the winter months of 1812–1813, in which the allied army remained in cantonments no hostile movement of importance took place. Every effort was made to repair the losses of the last campaign and to restore to the troops the vigour and discipline which the sufferings in the retreat from Burgos had impaired. Large reinforcements, especially of cavalry, and supplies of every kind, arrived from England; tents were provided for the first time for the men, and a pontoon train was fitted out. Altogether Wellington found himself in a most encouraging position. He had been appointed to the chief command of the Spanish forces and it was arranged that 50,000 native troops should be placed at his disposal. The enemy, moreover, was in sad plight. Napoleon's failure

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in Russia influenced the contest in the Peninsula. Thousands of veteran troops with Marshal Soult, the ablest of the French Generals in Spain, had been recalled to the Emperor's standard in Germany. The Partidas, or Spanish guerillas, swarmed everywhere, and the people of the country were hostile. On the other hand Joseph Buonaparte, who now commanded the whole of the French forces in Spain, was still superior in numbers to the allied army. He had concentrated his armies in the north and fixed his headquarters at Valladolid, where he had some 60,000 veterans with him, under Marshal Jourdan, and Generals Reille and Dubreton.

The forward march of the allied army was delayed until the green forage was fit for use, then on the 16th May it was begun in three separate columns. The first or left column, consisting of five divisions under Sir Thomas Graham, crossed the Douro and moved up its right bank through the wild and mountainous country of Tras os Montes. This turning column encountered great difficulties from the absence of roads, but by taking this route it reached the Lower Esla River almost unknown to the French and certainly unopposed. The right column under Sir Rowland Hill advanced on Salamanca by Alba de Tormes, while the centre column under Wellington himself moved on the same point by the more direct route. The centre column was composed of the Light Division, a brigade of cavalry and a corps of Spaniards. Reid was attached to the Light Division. So rapid was the advance of the centre column that the cavalry entered Salamanca as the French rear guard was leaving it, and General Fane captured 200 men and some guns. Joseph Buonaparte then retired on Burgos.

By the end of the month, to the surprise of the enemy, Wellington had concentrated his three columns on the right bank of the Douro, driving all before him. His bridge of communication was at Pollos, his stores at Zamora and Valladolid, and he had captured large magazines of grain at Arevalo.

Wellington's concentration on the Douro has been well termed the first act of a splendid drama, of which the movement towards the Ebro and the passage of that river was the second; the Battle of Vittoria, the catastrophe; and the crowning of the Pyrenees, the end. Napier says: "A grand design and grandly it was executed! For high in heart and strong of hand Wellington's veterans marched to the encounter, the glories of twelve victories played about their bayonets, and he, their leader, was so proud and confident, that in passing the stream which marks the frontier of Spain he rose in his stirrups and waving his hand, cried out 'Farewell Portugal!'"

The way to victory was open and on the 4th June Wellington "marched forward with a conquering violence."

It was under the eye of this leader that Reid, who was senior officer

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of Royal Engineers with the Light Division under Major-General C. Alten, took part in the brilliant campaign that followed. His services in the operations preceding and during the decisive victory gained by the great commander on the 21st June, 1813, at Vittoria are best described by his own General in a letter written two months later, which is given further on. It is a remarkable tribute to the military ability of this young subaltern of 22 years of age.

The enemy was concentrated at Burgos under Joseph Buonaparte. At the Hormaza River General Reille with a large force barred the way to the allies. When the Light Division came up to this place on the 12th June, General Alten with the help of cavalry turned the French position. The enemy then abandoned Burgos, blowing up the castle and fell back on "the impregnable rocks, the defile and forts of Pancorbo," in front of the river Ebro.

Wellington did not attempt to cross that river where an enemy was so strongly posted in front of it. He made a masterly turning movement by his left through a very difficult country to the sources of the Ebro, and crossed them at Rocamunde, San Martin, and Puente Arenas. Quite unprepared for this skilful manœuvre, by which they were cut off from some of the coast ports, and found a large force on their flank, the French abandoned Santander and other ports. Wellington then brought round his left wing and descended through steep passes and narrow defiles towards the great road of Bilbao.

On the 18th of June the Light Division came in contact with a division of French infantry on the march from Frias to Vittoria. Alten attacked and defeated them capturing their baggage. Some 400 French soldiers were killed or taken prisoners. To Reid his General ascribes in great part the success of this fight. On the 19th the enemy's position on the Bayas River was turned by the Light Division and Reille was forced over the Zadora River. Again Reid was to the fore and was given charge of the attack with a Portuguese battalion, and again he won the enconium of his General for the way in which he had performed the service. The allied army encamped that night on the Bayas River and rested on the 20th.

On the 21st the French armies formed three lines behind the Zadora River in front of Vittoria. The battle was begun soon after daylight and lasted till sunset. The Light Division, on this memorable day, was in the centre under the personal direction of Wellington, and while it is impossible here to enter into the details of the fight, at least it may be said that this division contributed in no small degree to the completeness of the victory gained. And no victory was more complete and decisive. The French Army became a vast mob. The whole of the baggage of the army, the military chest, even the baton of Marshal Jourdan and the court equipages of Joseph Buonaparte were captured, while 151 guns with an enormous quantity of ammuni-

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tion fell into the hands of the allies. Joseph Buonaparte himself narrowly escaped capture.

History indeed repeats itself. Nearly 450 years before, near the same spot, had been fought a famous battle for a crown. Then also it was the English who were the victors over the French, and by their victory restored a legitimate sovereign to a Spanish throne. On the 3rd April, 1367, Edward, the Black Prince, totally defeated Henry the Bastard at the Battle of Navarette, or Najera, a village close to Vittoria and only a few miles higher up the Zadora River. By this victory also he seated the legitimate sovereign, Don Pedro, on the throne of Castile. Moreover the rout of Henry the Bastard had much in common with that of Joseph Buonaparte. Froissart tells us that "the French and Arragonese made a desperate resistance and gave the Good Knights of England much trouble," until the French "could no longer keep the ground, but began to fly in great disorder"; then Henry the Bastard, "perceiving his army defeated without hope of recovery, called for his horse, mounted it, and galloped off among the crowd of runaways." The English pursued and, just as occurred centuries after, gained great plunder, for Henry like Joseph "had come thither with much splendour."

Detaching Sir Thomas Graham with a corps to Giupuscoa by the Adrian Pass in the route to Bayonne, and leaving a division at Salvatierra, Wellington with a large force, including the Light Division, pursued Joseph Buonaparte on the 23rd June. The next day the Light Division came up with the French rear guard. Two battalions of riflemen pushed through the pass, and Ross's Horse Artillery, galloping forward, dismounted one of the only two pieces of ordnance carried away by the French from the field of Vittoria. On the 25th the enemy retired up the Roncevalles Valley covered by the fortress of Pampluna. The Light Division pursued them as far as Vitalba when it was recalled. For then it was that Wellington heard of General Clausel, who, ignorant of the defeat of Joseph Buonaparte at Vittoria, had arrived there with 14,000 men to join the French Army on the evening of the 22nd, and on learning the news had hastily retired towards Logroño. Leaving Sir Rowland Hill to invest Pampluna Wellington marched by Tafalla to intercept Clausel. Finding his way into France barred Clausel recrossed the Ebro, and hurried to Zaragoza, and thence by Jaca across the frontier.

By the end of the month the armies of Joseph had returned to France, leaving garrisons behind at Santora and at the strong fortresses of Pampluna and San Sebastian. Santora was masked, Pampluna was rigidly blockaded, and San Sebastian was invested by Sir Thomas Graham preparatory to its siege. Reid's services were now required at San Sebastian for siege duties. Before following him there I append the letter of Major-General Count Charles Alten, written on

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the 27th August, detailing for the information of the Commanding Royal Engineer, Sir Richard Fletcher, the services which Reid had rendered while attached to the Light Division. The reason for writing the letter is alluded to by the writer. On the occasion of the great victory of Vittoria, the Prince Regent had distributed rewards to the army very bountifully. Wellington received the baton of a Field Marshal, several generals were created Knights of the Bath, and promotions were given with a lavish hand to the officers mentioned in despatches. But the young Engineer subaltern who had been through so many sieges and actions, and had been mainly instrumental in winning the day for Alten on the 18th June, had been again passed over. When the letter was written Fletcher was directing the Siege of San Sebastian, while Reid was not yet recovered from the severe wound he had received at the assault of that fortress a month before. Fletcher himself was killed at the assault and capture of the town on the 31st August. Whether by that time he had personally read Alten's letter of the 27th cannot now be known. At any rate it lacked the support that he would have given it, and like all the previous recommendations it was ignored by the military authorities at home. One is forced to believe that John Squire was right when he wrote to Reid—in the letter already quoted—"that noble birth and great interest have far greater weight with our men of power than real merit." It seems clear that no amount of military backing from the field of war without the influence of powerful friends, which Reid did not possess, would have availed to secure promotion that was contrary to red tape rules.

Letter from Major-General Charles Alten, Commanding the Light Division of the Army in the Peninsula, to Colonel Sir Richard Fletcher, Commanding Royal Engineer with that Army.

"PUENTE DE LISACA, *27th August*, 1813.

"MY DEAR SIR RICHARD,

"Seeing the Artillery and other officers of this army so handsomely rewarded for their signalized services in our present campaign, I cannot in justice to Lieut. Reid of your Corps, attached to the Light Division under my command, refrain of mentioning to you his very gallant and distinguished conduct while so attached, and to beg you will use your interest in his behalf that something may also be done for him, so deserving of reward.

"His activity and zeal for the Service in general will seldom be met with, and I am confident cannot be surpassed; this I know you are acquainted with. I therefore only beg leave to mention some particular occasions when he distinguished himself during the time he was with this Division.

"On the 18th of June, when I happened to meet unexpectedly on the march a French division, he not only did his utmost in reconnoitring the

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strength and the direction it took, but he also directed the movements of three rifle companies in such an able and spirited manner that I cannot help ascribing in a great part the success of the day to it. On the 19th, when the 4th Division came up with the enemy's vanguard, and Lord Wellington ordered me to attack their left flank I gave him the direction of it with one Caçador Battalion, and I cannot sufficiently express my satisfaction in the way he performed this service. In the Battle of Vittoria I derived the greatest assistance from his judicious advice and unrelaxing activity. He was the whole day constantly employed in rendering himself useful, exposing himself to the hottest fire, and had his horse killed under him. When we afterwards entered the Pyrenees, where the difficulty of the ground gives such ample scope for an Engineer officer in particular, he exerted his talents in ascertaining and sketching the position of the enemy, and in finding out the best roads and ways leading to it.

"Of Lieut. Reid's gallant conduct at the present Siege of San Sebastian and that on former occasions you are better acquainted with than myself. I can therefore only add that I should feel exceedingly happy if you should succeed in obtaining some reward for a young man who is so highly deserving of it.

"I remain, with great regard,
"My dear Sir Richard,
"Yours truly and faithfully,
"CHAS. ALTEN,
"M.-Genl.

"COL. SIR RICHARD FLETCHER,
"Etc., etc., etc."

I now turn to the Siege of San Sebastian, the seventh great siege in which Reid had been engaged. Here he was again distinguished, and was wounded for the third time in an assault of the place.

The town of St. Sebastian is situated on a low peninsula, running north and south, with the harbour on the west side, and the river Urumea on the other. On the north of this peninsula lies Monte Orgallo, a conical hill, some 400′ high, washed by the ocean; its southern face, bristling with batteries commanded the town, from which it was separated by defensive walls. The hill was crowned by the castle of La Mota. The town was protected both on the harbour side and on the river side by a rampart wall, but on the southern, or land front, 350 yards across, was a single front of fortification covered by a hornwork; 600 yards from this work the isthmus was closed by the ridge of San Bartolomeo occupied by the French.

On the other side of the Urumea were some sandy hills, called the Chofres, and to the north of these rose Mount Olia, which commanded the castle of La Mota at a range of some 1,300 yards. Major Charles Felix Smith, R.E., was the Commanding Engineer

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until the arrival of Sir Richard Fletcher, and he proposed to form breaches in the town wall on the Urumea side from batteries on the Chofre sandhills, and then storm at low water.

At this siege 2 lieut.-colonels, 2 majors, 5 captains and 9 subalterns of Royal Engineers were employed. Of these 18 officers, 1 lieut.-colonel, 2 captains and 1 lieutenant were killed; and 1 lieut.-colonel, 1 captain and 5 lieutenants were wounded. Ground was broken on the 11th July. Then, when the batteries were armed, the fortified convent on San Bartolomeo was bombarded for some days and taken by assault on the 17th July. On the 21st the parallel across the isthmus was opened.

The following extract from Burgoyne's journal refers to Reid at this date :—

"*July 22nd.*—Lieut. Reid, observing the drain of the aqueduct, where it was cut through in our parallel, to be large enough to get into, explored it; and with much difficulty and perseverance went completely through (240 yards) to where it ended in a fastened door in the counterscarp, opposite the face of the right demi-bastion of the hornwork, into which, through chinks in the door, he was enabled to look. The ditch appeared narrow, the escarp about 24′ high, the drain on the level of the bottom of the ditch. It was determined, in consequence of this discovery, to make a globe of compression in this drain, and endeavour to force earth enough from the counterscarp and ditch to form a ramp up the escarp of the hornwork. Lieut. Reid, assisted by Lieut. Matson, is directed to take charge of the arrangement of this mine.

"*July 24th.*— . . . The mine was all loaded ready, but not tamped, in consequence of the difficulty caused by the great length of so confined a gallery, and from want of air, which began now to be experienced. The powder was put in barrels; the gallery would only contain two on their sides, and then one on its end, and so on alternately; the length occupied therefore by the 30 barrels was very great."

The explosion of the mine by Reid, which was to be the signal for the assault, took place about 5 a.m. on the 25th. The assault of the hornwork by the storming party, guided by Lieut. H. D. Jones, R.E., was quite successful but the supports were late. The enemy, seeing only the storming party, were soon rallied and poured a destructive fire into them. Many retreated; Jones and those who stood their ground were mostly shot down. When the supports arrived they were met by the retiring remnant of the stormers and fell back with them. In this disastrous affair Lieut. Machell, R.E., was killed, and Lieut. H. D. Jones wounded and made prisoner at the breach, while endeavouring to rally the men. Lieut.-Colonel Sir Richard Fletcher, Capt. Lewis, and Lieut. Reid of the Engineers were also severely wounded.

Reid had been struck by a musket ball in the neck, and fell covered

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with blood, which streamed from his mouth and nostrils. At first the wound was thought to be mortal, but on examination it was found that the black silk handkerchief he wore round his neck had been pressed into the wound and, on withdrawing it, the bullet came with it. Although he recovered rapidly from this severe wound he was not again able to take part in the siege, which was suspended for nearly a month to await the arrival of additional ammunition, guns, and stores from England, and when resumed on the 24th August only lasted a week, the town falling to assault on the 31st August. At this assault the Engineers lost heavily. Lieut.-Colonel Sir Richard Fletcher, Bart., Commanding Engineer, was shot through the heart; Capts. Rhodes and Collyer were killed on the breaches; and Lieut.-Colonel Burgoyne, and Lieuts. Barry and Marshall, were wounded.

Burgoyne says in his journal, that Sir Richard Fletcher, Commanding Engineer, "headed the first party that made a push for the curtain, and fell on the summit, covered with wounds (11)."* The castle held out for another week before the Governor surrendered.

While laid up by the wound he had received on the 25th July Reid was one of the signatories to the Memorial, dated 20th August, 1813, of the officers of Royal Engineers serving under Field Marshal the Marquess of Wellington in Spain to the Master-General of the Ordnance, representing the inadequacy of their pay and allowances to support the heavy expenses to which they were liable on active service in the field. The truth of the matter was that the officers of the Corps, except at sieges, were constantly employed as staff officers, and were obliged to keep three or four horses and a couple of grooms in order to perform their duties, while they had not the advantages, the status, or the emoluments enjoyed by officers on the General Staff of the Army.

* There is a monument to the memory of Sir Richard Fletcher in Westminster Abbey at the west end of the Nave.

(To be continued).

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REVIEW.

SPON'S ARCHITECTS' AND BUILDERS' POCKET PRICE BOOK, 1910.—(Size $6\frac{1}{2}'' \times 3\frac{3}{4}'' \times \frac{9}{16}''$).

This work contains in a convenient and readily accessible form, prices for measured work arranged by trades. Its cost is 3s. net, which compares favourably with the general price of such pocket books. The book is divided into two parts: Part I. is a summary of useful memoranda and tables in connection with the various materials used by engineers and builders and of questions arising in those professions; it includes such items as the size of a croquet lawn, the requirements for an air gas installation, and the law concerning casements. Under Part II. for each trade there are tables for constants of labour and material, prices for measured work, and day work prices, so that with the help of a good index at the end of Part II. an approximate estimate can be quickly arrived at by allowing a proportion between the tabulated prices and the current prices in the district in question. The book has the further advantage of being printed on superior paper with clear legible letterpress.

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NOTICES OF MAGAZINES.

JOURNAL OF THE MILITARY SERVICE INSTITUTION.

January, February.

Under the title "Artillery for Airship Attack," are described the three general classes of ordnance—manufactured by Krupp—for firing at great heights against aerial craft. They include—(I.). Field type. (II.). Automobile type. (III.). Fixed type.

The maximum elevation of fire is 70° for the first, and 75° for the others.

Type I.—Field gun type, fitted with hydraulic recoil.—Bore, 2·6″; weight of projectile, 9 lbs.; weight of gun (alone), 775 lbs.; weight of trail, etc., 1,150 lbs.; total weight of gun and carriage, 1,925 lbs.; maximum vertical angle of fire, 70°; muzzle velocity, 2,050′ per second; maximum range (horizontal), 9,500 yards; maximum range (vertical), 18,800′. The wheels are pivoted so that they can be turned crosswise.

Types II. and III. differ from Type I., in that they are mounted on a central pivot allowing of rapid traversing round the complete circle.

Type II.—Automobile type with hydraulic recoil and central pivot.—Bore, 3″; weight of projectile, 12 lbs.; weight of gun, 990 lbs.; weight of support, 1,550 lbs.; total weight of gun and mounting, 2,540 lbs.; maximum vertical angle of fire, 75°; muzzle velocity, 2,060′ per second; maximum range (horizontal), 10,000 yards; maximum range (vertical), 20,000′; weight of automobile, 3½ tons (exclusive of gun and mounting); average speed, 30 m.p.h.; motor, 50-H.P.

Both axles of the car are driving axles, and it can therefore be manœuvred over rough and steep ground. To ensure steadiness, the platform is rigidly fastened to the axles, and in the general design ample space is allowed for ammunition and all spares, while vulnerable parts can be armoured. Gears for traversing the gun are quick-acting as well as slow motion.

Type III.—The fixed type, pivot mounted, resembling Type II. in general details but heavier and more powerful, is intended for use on coast defences, torpedo boats and swift cruisers and can of course be used as an ordinary gun.—Bore, 4·2″; weight of gun, 3,080 lbs.; weight of support, 3,520 lbs.; total weight of gun and mounting, 6,600 lbs.; muzzle velocity, 2,300′ per second; maximum range (horizontal), 14,800 yards; maximum range (vertical), 37,620′; maximum vertical angle of fire, 75°.

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Rapidity of fire is, in all cases, obtained by the automatic opening and closing of the breech.

The sighting is telescopic, aided by a general finder with a large field of view. The range is first obtained by a range-finder, subsequent ranges and elevations for different positions of the airship being obtained directly, without the necessity for using range tables.

Various experiments have been carried out for determining the best form of projectile. It has been found that the rents made by shrapnel bullets in the envelope, are usually closed again by the internal pressure of the gas, and in most cases the airship can reach a place of safety.

The most effective form of projectile is a species of grenade, fitted with a very sensitive percussion fuze, exploding in the interior of the envelope and causing the ignition of the gas. The path of the projectile is marked by a trail of smoke that facilitates ranging, the smoke-producing device being ignited on the firing of the gun. At night the track of the grenade is visible by the light emitted by the smoke-producer.

W. H. Bunbury.

Nature.

January, 1910.

Mosquito or Man.—By Sir Robert Boyce (*p.* 158).—The author endeavours to show that the diseases of the tropics stand, so to speak, by themselves and thus require special teaching in the medical schools of this country. Take Uganda for instance, all the harm that the climate does for you there is to give you a sunstroke if you go out in the heat of the day with inadequate headgear, and to make it very difficult to keep awake after lunch; most of our familiar plagues such as tuberculosis, rheumatic fever and influenza appear to be absent. The diseases that are really to be feared are all such as spring from bites of arthropads. If you protect yourself from the mosquito you will not get malaria; avoid the tsetse fly, which is very easily done, and you are safe from sleeping sickness; do not sleep on mud floors nor pitch your tent on old encampments, and relapsing fever will not trouble you; keep rats and flies at a distance, and you are safe from the plague. With a little care and attention to surroundings, the European will find his life in the tropics, if anything, more free from disease than in our temperate, but influenza-ridden palæarctic climate. The historical survey of yellow fever contained in Chapter XI. gives an idea of what the West Indian islands were like in the old days, when the Secretary for War in England in 1783 wanted to know from the Governor of British Guiana why in a few months 69 per cent. of the white troops had perished and it is said of the slopes of the Morne in St. Lucia that there is not a square yard without the remains of a soldier under it. Chapter XIV. contains an account of the anti-yellow fever campaign in Havana in 1900. Havana had been a notoriously

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unhealthy place, 35,932 persons perishing of yellow fever between the years 1853—1900, this being equivalent to 754 a year, or to two deaths a day, and now after a thoroughly efficient sanitary administration and a special raid upon the breeding places of the slegomyia, the death rate of Cuba has come down to between 11—17 per thousand, only one case of yellow fever having been reported at Havana last year. Equally remarkable are the results that follow the extermination of anophelines for malaria. Ross began his anti-malarial campaign at Ismailia in 1901 when every inhabitant was infected, by 1904 the cases were diminishing fast and by 1908 there were no new cases at all, indicating that the disease had been entirely stamped out. The book is clearly and ably written, is most interesting to read, is illustrated by beautiful photographs and does credit in every way to its author.

DIRIGIBLE AIRSHIP COMPANIES (*p.* 344) are moving fast in Germany. A Parseval airship was ordered this month by the Munich Aeronautical Company, the share capital of which is 400,000 marks. It is to be delivered on 1st May when regular aerial tours are to be commenced. An airship station is to be made in Upper Bavaria, to which flights will be made from Munich. The municipality of Grägrath has placed 68 acres of ground at the disposal of another company which has been founded for exploiting motor-driven airships according to the system of Herr Zarn and for establishing air lines. Major Von Parseval has been appointed to lecture on dirigible airships at the Charlottenburgh High School.

THE LIFE OF SIR CHARLES WILSON, R.E., K.C.M.G. (*p.* 311), by Colonel Sir Charles Watson, belongs to that class of biography, which as Carlyle held, ought to be written; of such materials as this "life" will future history be made. His career was one of those devoted to the public service, and of the highest usefulness, unrecognized by, and hardly known to the ordinary world of newspaper readers. In Wilson's case, were it not for the accusations, long since withdrawn as totally unfounded, of a failure on his part to do all that was humanly possible to relieve Khartum before its capture by the Mahdi, his name would possibly be little known.

The first important post that Wilson filled (after his entry into the Royal Engineers) was that of Secretary to the British Commission for delimiting the boundary between the United States and Canada from the Lake of the Woods to the Pacific along the 49th parallel of latitude. The line as then marked out was not a true parallel of latitude but quite as near as could be traced within any reasonable limit of time. The urgent point was to get some acceptable boundary marked out on the ground so that nobody could have any doubt as to which side of the line they were on at any given moment. The country traversed by the line was almost unknown and of an extremely wild and mountainous character. The winters were very severe, and though little more than a boy, Wilson was trusted with the duties of the commissariat—acting as store and transport officer.

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Soon after the termination of this Commission, he was employed on the survey of Palestine and the surrounding region, a work which occupied his energies for a large part of his life.

In 1867 he again went to the East to carry out a special task for the Palestine Exploration Fund, the survey of the Sinai Peninsula, in order to identify Mount Sinai and to elucidate the events of the Bible history.

Wilson's share in the Nile Expedition of 1884, and in the attempt to relieve Khartum and rescue Gordon is dealt with at length. The author, as a lifelong friend of Wilson, welcomed this opportunity of putting on record his version of the history in view of the opinion strongly held by him that Lord Cromer in his *Modern Egypt* was less than fair to Gordon.

In 1878 Wilson was appointed to delimit the Turco-Servian frontier and he afterwards served as Consul-General in Servia. He was for seven years, 1886–94, Director-General of the Ordnance Survey and then for three years he held the office of Director of Military Education.

The present biography is written in a simple style and gives a clear account of the events of which it treats.

W. E. WARRAND.

REVUE MILITAIRE DES ARMÉES ÉTRANGÈRES.

December, 1909.

(1). THE MILITARY FORCES OF PERU.—Every Peruvian is liable to serve between the ages of 19 and 50. From 19 to 23 in the regular army, from 24 to 30 in the 1st class reserve, from 31 to 35 in the 2nd class reserve, and the remainder of the time in the national guard. In mounted branches the time of service in the active army is four years, and in the dismounted branches three years. Young men between the ages of 19 and 23 who are not serving in the ranks of the regular army, are known as supernumeraries, and may at any moment be called to take their place in the ranks, to bring their corps up to strength. The 1st class reserve is called out for two months in the year, the 2nd class answer a roll call at headquarters once a year, and the national guards are not supposed to absent themselves from their town of origin.

The strength of the regular army is 4,000 men, and it is composed as follows:—

Artillery.—A regiment of mountain artillery of 2 brigades, each consisting of 2 four-gun batteries; a brigade of field artillery, *i.e.*, 2 four-gun batteries; a company of fortress artillery; a company of sappers. The field artillery is armed with the 75-m.m. Q.F. Schneider-Canet gun, and the fortress artillery with a battery of 152-m.m. and 2 batteries of 24-c.m. Q.F. Schneider-Canet guns.

Infantry.—6 battalions of 4 companies each.

Cavalry.—6 squadrons, including the escort of the president. The infantry are armed with the 1891 pattern Mauser, and the cavalry and artillery with the Mauser carbine.

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The staff was organized in 1901, and reorganized in 1906 by officers lent by the French Government. It is divided as follows:—No. 1 Section—Military operations, recruiting and education. No. 2 Section—Mobilization. No. 3 Section—Historical documents, information on foreign armies, and the library. The staff is assisted by:—The cavalry, artillery and infantry inspections; the engineer department; the topographical department. These are also controlled by French officers.

The military college of Peru is at Chorrillos, and comprises 2 divisions: the senior, 100 strong, is for those who intend to become officers; the course for these pupils lasts four years. The junior division, 700 strong, prepares N.C.O.'s for the army. The school of musketry is in the same buildings as the military college, and trains officers in a six months' course in the use of the machine gun as well as of the rifle. Only specially selected officers are sent there, and as the ammunition grant is most liberal, the course includes a large amount of experimental work. The veterinary school trains a few officers, but its main object is the provision of smiths for the army. The supply and medical departments are under the direct command of the War Minister.

(2). THE ENGLISH GRAND MANŒUVRES OF 1909.—The operations of the 20th, 21st, and 22nd September are described, and the article concludes with a large number of observations on the British Army generally, of which the following is a brief *résumé*:—(1). The advanced guards used were too weak; they were used too much, merely as protective troops, and not as bodies to be manœuvred. In consequence, the main body not only often extended too soon, but the reserves were also thrown in too soon. (2). The infantry distinguished itself by the length of some of its marches. Although the British soldier has less to carry on his back than the men in most Continental armies, manœuvres are harder for him than for the others, as he has to fight all day, and bivouac all night. Good use was invariably made of natural cover. (3). The cavalry was very energetic. It showed perhaps a tendency to seek out the opposing cavalry, rather than combine with the other arms. It proved itself to be especially good at dismounted action. The condition of the horses was very good. (4). The artillery supported its infantry very well on all occasions. Good communication was kept up between battery and brigade commanders. (5). The desire to adopt the offensive was prevalent throughout.

(3). THE MANŒUVRES OF THE AMERICAN MILITIA.—The following is a *précis* of the observations on these operations:—(1). Both officers and men proved themselves to be really useful, and stood the test well in spite of the inclement weather. (2). The transport, which was supposed to include more than the regulation number of vehicles was swelled by the addition of numerous carts of all descriptions, with various unauthorized loads. (3). Two 37-m.m. naval guns were mounted on heavy motor cars, of 24 to 30-H.P. with solid india-rubber tyres. The car also carried

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the detachments (three men and a N.C.O.) and the ammunition. These cars were, however, used more as means of transporting troops rapidly to a given place to carry out some operation, than as guns. In the opinion of the directing staff, the guns might with advantage be replaced by machine guns, and the number of cars increased. (4). Eleven other motor cars of the same type were employed, two as hospital cars, and the remainder for transport purposes.

(4). Foreign News of Different Countries.—*Austria.*—The mountain troops are to be supplied with large company mess tins which work on the "Thermos flask" principle. They will be carried on mules. *Belgium.*—Conscription is to be shortly replaced by universal military service. *Germany.*—The number of admissions to the Staff College was greater by 27 in 1909 than in 1908. This number will slowly be increased from 400 to 480 officers per annum. No officer having over 10 years' service will in future be admitted to the Staff College. In consequence of the creation of 1 company of machine guns per infantry regiment, steps are being taken to form a reserve of officers to fill the ranks of these companies on mobilization. A new helmet is being issued to the infantry. It has a green cover, the badges on it are in dull bronze, and the spike can be removed when carrying out field operations. The front and back can be lifted up, so that the wearer shall be comfortable when firing in the lying position. The cavalry have been ordered in future to carry their swords fixed to the saddle, except when on ceremonial parades. Eleven German officers of all three arms have been lent by the government to the Sultan to train the Turkish Army. *Holland.* — Two cyclist companies and 2 mounted machine gun detachments have recently been formed. *Italy.*—Important modifications have been lately made in the conditions of admission to, and the programme of studies at the Staff College. In future 100 officers of all arms will be admitted to the college. There are only three written papers: military law, military history, and topographical drawing. The oral subjects are:—Questions on the written subjects, and also on administration, military geography, French, and either English, German or Russian. Under the title of "Specialists' Brigade" have been grouped together 2 specialist companies, a wireless telegraph section, a photographic company, and a company of "train." The Italian military dirigible No. 1 Bis. travelled, on the occasion of the visit of the French Mediterranean squadron, from Bracciano (near Rome) to Naples, and back again (a distance of 500 kilometres) in 14 hours 25 minutes. The capacity of the balloon is 3,500 cubic metres. The envelope is divided into eight entirely separate compartments; of which seven are filled with hydrogen, and one with air. The stiffness of the envelope is provided for by means of a metallic framework. The airship, normally, only carries four passengers, but can carry as many as eight. The War Ministry has decided on the adoption of the following new articles of medical equipment:—(1). A stretcher for the use of Alpine troops. (2). A stretcher which can be rolled up and taken into two pieces, and can be easily carried by pack animals or in a carriage as required. (3). Trestle

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legs to support stretchers in the field, whilst preliminary dressings are being carried out. (4). Acetylene lamps to assist in looking out for wounded men on the field of battle at night. (5). Acetylene lamps to indicate hospital tents. (6). Iron bedsteads for use in surgical operations. *Russia.*—Changes at the Staff College.—The conditions of admission have been altered, formerly no officers above the rank of 2nd captains were admitted; now, admission is possible to officers up to the rank of 1st captain. No officers who have served for less than three years with their regiment and taken part in two periods of summer training are allowed to compete, except in the case of officers who are desirous of joining the geodetic section. On leaving the academy, these officers cannot of course occupy any staff billets except in the geodetic section. The entrance examination is in two parts; the written, and the oral. The former consists of:—(1). An essay on some tactical subject. (2). The solution of a tactical scheme. (3). An essay on political history or geography, at the choice of the candidate. The oral part includes:—(1). Military law. (2). Administration. (3). Artillery. (4). Fortification. (5). Elementary mathematics. (6). Political history. (7). The Russian language. (8). German, French, or English. (9). Geography. (10). Topography. The study of one foreign language only is required, instead of two as formerly, but the knowledge possessed by the candidate of that one language must be very thorough. Officers obtaining an average of 83 per cent. on the course, are, on leaving the school, attached to divisional staffs, and on completion of the training season go back to their units, till there is a vacancy for them on the staff. They also receive a year's pay, four months' leave on full pay, the right to change their corps or arm, and are recommended for a decoration. For the officers who obtain less than the above-mentioned percentage, the advantages are the same, but they are not recommended for a decoration; they go straight back to their units.

A. H. SCOTT.

RIVISTA DI ARTIGLIERIA E GENIO.

December, 1909.

REVIEWS OF BOOKS.—*Pro Calabria e Sicilia.*—By Engineers V. Gianfranceschi and G. Revere.—This work, which relates to the construction of buildings in those regions of Italy that are subject to seismic movements, is published by the Lombard Co-operative Society of Public Works, under the auspices of the College of Engineers and Architects of Milan. It has been very favourably judged by the committee of that assembly, a second prize for merit being awarded to the authors.

After a careful examination of the various points to be considered in constructions of this kind, the authors propose, for the foundations, a

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system of ample areas, not morticed to the ground, but, as it were, resting on it and rigidly joined to the superstructure.

For ordinary walls a special type of construction is proposed consisting of hollow blocks of cemented masonry. These however do not include walls for structures of wood or iron.

AUSTRIA-HUNGARY.—*Formation of Balloon Detachments.*—From the *Militär Wochenblatt* we learn that in January next a detachment of balloonists will be formed in Austria. Up to the present time the balloon service was entrusted to the section formed for studying military aeronautics and attached to the 1st Regiment of Fortress Artillery of the garrison of Vienna, its *personnel* being composed of 12 officers and 20 men under whose instruction 20 officers and 150 men of the troops of the various arms were attached.

The Austrian military aerostatic park which, up to the present time, consisted only of spherical balloons and of *drachen*, will next year be augmented by three dirigible balloons, viz.:—A Parseval with a capacity of 1,800 cubic metres with a Daimler motor; a Lebaudy of about 3,000 cubic metres with a Daimler motor supplied from the Austrian Society for the construction of aerostats; and a third dirigible with a capacity of 2,000 cubic metres. These dirigibles are required to travel with a velocity of 45 k.m. per hour, to carry a crew of five men; the height of flight being not less than 1,500 m., and its duration not less than eight consecutive hours.

The balloon detachment will be stationed at Fischamend where there is a hangar for balloons 180 metres long and 20 metres in height. The troops will wear the same uniform as the regiment of railway telegraphists, with a distinctive design of a spherical balloon on the collar.

Troops for Communications.—By a decree of the 7th October a brigade of troops, for the line of communications, has been formed in Austria under the command of Major-General Schleger. This brigade will be composed of the regiment of railway telegraphists, the detachment of automobilists, the detachment of balloonists and the service for homing pigeons.

PROPORTION OF ARTILLERY TO INFANTRY DURING THE LAST CAMPAIGN IN MOROCCO.—An article from the *Memorial de Artilleria* of last November entitled *Hablan los hechos* gives details of the amount of artillery that was brought into action during the recent campaigns conducted by the French and the Spaniards.

Although, says the author, the campaigns were against an enemy unprovided with artillery and wanting both in discipline and in the good arrangements of regular armies, they possessed qualities which would render them dangerous unless adequate measures were taken against them.

At the commencement of the campaigns the insuperable difficulties of attacking a position without the aid of a strong artillery was evident. It was only by this means that the heavy daily fire of the enemy was overcome, and his skilful marksmanship and knowledge of the ground itself and how to make the best use of it was neutralized.

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From the first the Spaniards and French, recognizing all the advantages to be gained from artillery fire against the assaults of an intrepid enemy, had learnt the necessity of distributing strong artillery to the several corps, and the final proportion of guns was eight for 1,000 infantry, and four for 1,000 cavalry.

BRAZIL.—*New Places for Wireless Telegraphy Stations.—La Revue Scientifique* of the 13th November announces that the Brazilian Government has set up two stations for wireless telegraphy, one at Pernambuco, and the other at the island Fernando di Naronha.

The station at Fernando will be able to communicate with the trans-atlantic stations and to correspond directly with Dakar. The station at Pernambuco has a length of wave of transmission of 600 m.; that at Fernando, in addition to an installation similar to the preceding, has another with 60-H.P., and a length of wave of transmission of 1,800 m.

EDWARD T. THACKERAY.

THE AËRONAUTICAL JOURNAL.

January.

This number contains some interesting details by Mr. H. B. Molesworth, M.I.C.E., for determining the pressure of air on flat planes. The details consist of two tables giving alternative values for the force of wind, and a diagram of pressure curves to which to apply them.

There is also a brief description of the Sem-Jacobsen system of man-lifting kites which have been purchased by the Danish Government for the use of the Amundsen Polar Expedition during the coming year. This system consists of seven kites, of a modified Hargrave type, with either a linen gondola or a basket suspended beneath.

The team of kites comprises one kite of 5·3 square metres, four of 13 square metres and two of 21 square metres surface, all being built of bamboo (or magnalium tubing if preferred) covered with Egyptian cotton cloth or silk. The cable is of extra flexible steel wire, 8 m.m. thick, and the windlass is of the ordinary type with exchange and hand-brake.

The team can be used in a wind velocity of anything between 25 and 50′ per second, though a velocity of 27′ per second is sufficient to raise one man with six kites only, or two men with seven kites.

Ascents have been made to a height of 2,600′.

The whole apparatus, which costs approximately £170, can be stowed away on an ordinary wagon, and can be fitted up ready for an ascent in half an hour by eight men.

W. H. BUNBURY.

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PLAN OF
No 4 GENERAL HOSPITAL
MOOI RIVER NATAL
1902

REFERENCE

Fences marked thus ——•——•——

Water supply " ——·——·——

Electric Light wires " ——×——×——

Scale 238ft to 1in (1/2856)

Ft 100 50 0 100 200 300 400 500 600 FT

Road to Howick & Rensmuts Depots

Road to Pietermaritzburg

900'

Disinfecting Hut Incinerators

Coal Bunkers

Mortuary

Serfs Kits

Serfs Mess

Serfs Latrine

Ballantynes Land

Tennis Court

Destructor

Rubbish Bins

Indian Kits

Transport Paddock

Hangers

Indians

Indians Natives Overseer

Latrines

Q.M.Stores

Isolation Encl.

Staff Stables

Staff Mess

Detachment Recreation & Dining Room

Kitchen

Coal Bunker

Night Orderly Sleeping

Ablution Rm

Night Orderly Sleeping

Native Night Police Tent

Barbers Tent

R.A.M.C.

Natives

Native Kits

Detachment Latrine

Canteen

Carpenters

Detachment Latrine

Ballantynes Land

Kitchen

Overseer

Utensil Store

Waste Water Tank

Disinfecting Encl.

Medical Latrine

Eating Encl.

Medical Ablutn Rm

Officers Latrine

Guard Tent

Medical Wards

Kitchen

Pack Store

Linen Store

Pavilion Store

Recreation Rm

Special Ward

Night Sisters Rm

Chapel Dispensary

X-Ray & Op. Theatre

A & C

Nursing Sisters

E

Disinfecting Encl.

Surgical Latrine

Surgical Ablutn Rm

Surgical Wards

Elevated Tank 4500 Gls with Filters under

Note.

A. Medical Office

B. Post Office

C. Night Duty Tent

D. Surgical Office

E. Registrars Office

Town Lands

Pole with Two Lights

P.M.O. Office

Officers Latrine

Officers Kitchen

Officers Mess

Sisters Mess

Stores

Sisters Kitchen

Sisters Latrine

Native Latrine

Officers Tennis Court

Barometrical Enclosure

Sisters Tennis Court

Officers Wards

Stores

Dining Rm

Kitchen

Orderlies

Approx North

P.C.

Disinfecting Encl.

Electric Light Main

Ballantynes Land

Cultivated Land

Horse Sick Land

760'

Cultivated Land

Pumping Station

MOOI RIVER

Road to Station

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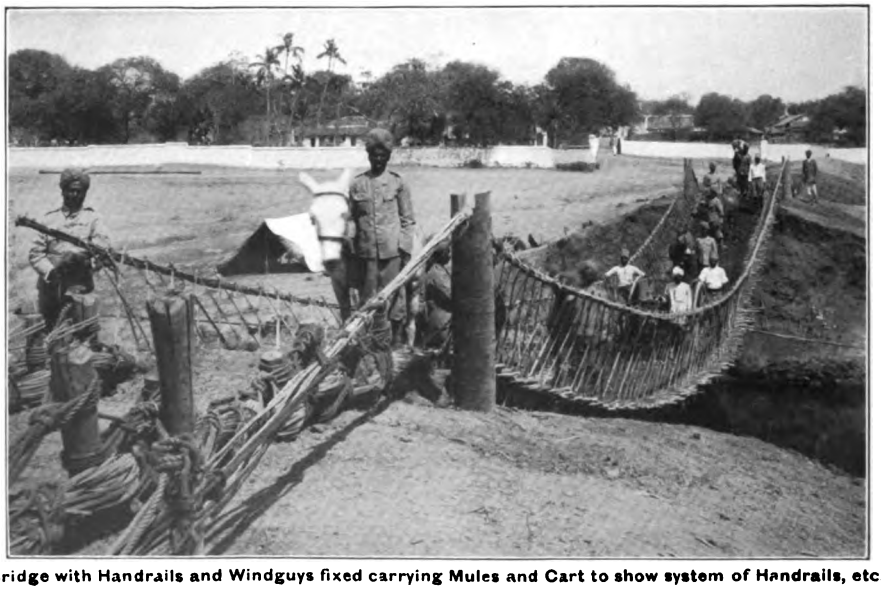
A BAMBOO-CABLE SUSPENSION BRIDGE.

Bridge under construction showing Cables and Corduroy Roadway.

Bridge with Handrails and Windguys fixed carrying Mules and a Cart.



Bridge with Handrails and Windguys fixed carrying Mules and Cart to show system of Handrails, etc.

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A BAMBOO-CABLE SUSPENSION BRIDGE.

By Capt. & Bt. Major R. L. McClintock, d.s.o., R.E.

In the December number of the *R.E. Journal* of 1906, there appeared a description of a sort of trestle bridge made entirely from small bamboos and suitable for carrying infantry in single file.

The object of the present article is to show how complete suspension bridges, *including cables*, can also be made from this useful material.

In an interesting book *The Marches of Hindustan* (David Fraser), the author gives some photographs of what he calls "birch twig" and "cane" suspension footbridges made by the inhabitants of Sikkim and Lahoul, respectively, across local torrents. Although he gives no description at all of these (beyond referring to them as "cane erections less safe than the Bridge of Sighs"), it appears from the photographs that they are ramp suspension bridges, with their cables made from fascine-like bundles of twigs or canes. They also appear capable of carrying one man at a time only.

The above account induced the 10th (Field) Company, 2nd Q.O. S. & M., during its last fieldworks course to devise a similar type of bridge which would at least carry infantry in single file and pack animals. The accompanying photographs show the result over a 120′ span. The bridge was constructed with no materials beyond the ordinary small female bamboo (one of the most common objects of the moister portions of the East), a few 1½″ lashings, some rough pickets such as could be cut in any wood, and some thin wire or even twine.

Construction.

(1). *Cables.*—The Indian basket maker, or "Chattai-wallah," when conducting the trellis-making branch of his handicraft, is accustomed to split the ordinary female bamboo into 12 strips. First the bamboo is divided longitudinally into six equal segments (ABCDEF, *vide Fig.* 1) by three radial cuts following the longer axis. Out of these six segments two (A and D) are rejected as they carry the

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knots, which spring alternately from opposite sides of a bamboo. Although rejected for cable-making these are not wasted as they come in later in connection with the roadway. Each of the remaining four segments (BCFE) is then split into three slats by two longitudinal and tangential cuts, thus :—

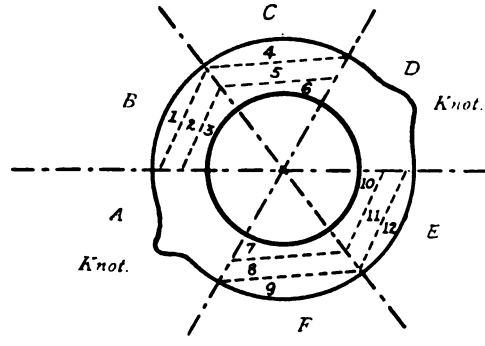

FIG. 1.—*Rough Sketch of Section of Bamboo.*

Each of these 12 slats will be as long as the original bamboo (say 10′—15′), will be $\frac{1}{2}$″ to $\frac{3}{4}$″ broad, $\frac{1}{16}$″ to $\frac{3}{16}$″ thick and will support over 300 lbs. on a straight pull.

The problem now is to connect sufficient of these slats into a cable of sufficient length and strength to sustain the calculated stress on the bridge. First a joint must be devised for connecting these slats end to end, which joint must be at least as strong as the slats themselves. Experiment showed that if the last 8″ or so of each slat was notched with a knife as shown in *Fig.* 2 and the notched ends of

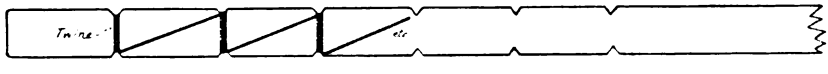

FIG. 2.

two slats superimposed and bound together with thin wire or twine, say 22 B.W.G. iron wire, or even ordinary thin twine, the junction was stronger than the slats themselves. Thus a continuous slat of any requisite length and with a breaking strain of about 300 lbs. could be obtained. This done, it is only a question of calculating how many such continuous slats are required to make a cable capable of carrying any given load. In the bridge shown, a F.S. of 3 being allowed, it was found that 200 such long slats were necessary in each cable to carry infantry in single file over 120′ span. The cables

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were made like long fascines, the requisite number of slats being first laid parallel, and then choked and bound at intervals of 1′ with twine or wire. The resulting "fascine cables" were about 18″ in circumference.

Wire and twine are mentioned above as used for joining the slat, but as a matter of fact the latter alone is necessary. In the bridge shown, for purposes of experiment, the junctions in one cable were made entirely with wire and in the other entirely with thin twine. No difference was observed in the efficiency of the two, so it may be taken that twine is amply good enough.

(2). *Anchorages.*—The question of anchorages at first presented a difficulty as the cables, although reasonably pliant, were too stiff to be taken round a sunk log in the usual manner. One thing was plain, that the straighter the pull the less the cables were likely to suffer. Accordingly a separate anchorage was made for each end of each cable, and each consisted of 20 pickets of 4″—6″ diameter, 2′ apart, driven 3′ into the ground. Each cable after crossing each shore transom was first served with a piece of 1½″ rope and then divided into two halves (A and B, *Fig.* 3), which were taken alternately right and left of each of the 20 pickets. These two halves of the cable crossed each other between every two pickets (CC), and each such crossing was served with a piece of 1½″ rope, which was then made fast to the picket immediately in rear of the crossing. This anchorage proved quite satisfactory and quickly made.

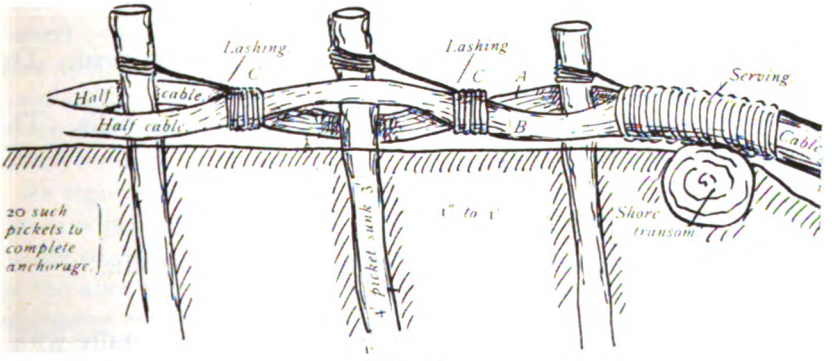

FIG. 3.

(3). *Roadway.*—The first roadway tried was one of ordinary bamboos laid close, side by side, corduroy-wise across the cables, and lashed down with log-line or twine (*Fig.* 3). This carried infantry well enough, but was quite unsuitable for animals. To carry the

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latter, the corduroy must be covered with hurdles, which can be made of bamboo also. A hurdle or mat, continuous over the whole length of the bridge and made *in situ*, is convenient and can be constructed largely out of the segments of bamboo rejected from the cables.

MATERIALS REQUIRED FOR A BRIDGE OF 120′ SPAN.

(4). *Cables.*—Two cables, each of 200 slats, each 210′ in length, actually consumed 660 female bamboos, averaging 10′—15′ in length, and about 1½′ diameter at the butt. This was about 60 in excess of the calculated requirements, so it appears that about 10 per cent. should be allowed for waste.

(*b*). *Roadway.*—1. First, 120′ span of corduroy roadway required 710 pieces of bamboo 7′ long, or 355 whole bamboos.

2. For 120′ span of continuous hurdle, about 1,000 of the segments, rejected when splitting the bamboos for the cables, are required. As there are some 1,320 of these available, no extra bamboos are required for this hurdle roadway.

Total bamboos, therefore, required for cables and roadway amount to :—660 + 355 = 1,015, or about nine per foot-run of span.

(*c*). Pickets, rough wood, 4″—6″ diameter and 4′ long. Eighty are required for the four anchorages.

(*d*). Lashings, 1½″ rope, actually used, but much smaller cordage would probably have done. Number, 80.

(*e*). Wire or twine for joining the slats in the cables.

1. Wire (in one cable), 22 B.W.G. iron wire, 50 lbs. used. This works out to about 15,000′.

2. Twine (in the other cable), thin parcel string, 51 balls. This works out to about 14,000′.

TIME REQUIRED TO MAKE 120′ SPAN BRIDGE.

The bridge as shown was made slowly and experimentally with a small number of men. The following were the observed times of the various operations :—

(*a*). Splitting bamboos for cables. Five basket makers can split 100 bamboos into 1,200 slats in 12 hours. As 660 have to be split, it may be assumed that 33 men could do it in 12 hours.

(*b*). Joining the slats. One man can turn out five complete slats each 210′ long in 12 hours. It may be assumed then, that the 400

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required for the two cables can be produced by 80 men in 12 hours. This is quite unskilled work.

(*c*). Choking and binding the long slats into cables. Six men can choke and bind one cable in 6 hours. Therefore they could turn out the two cables in 12 hours.

(*d*). Anchorages and roadway. Forty men can make anchorages, attached cables, and lay corduroy roadway in 8 hours.

(*e*). Hurdle roadway for animals. Two men can lay 15′ of continuous hurdle roadway in 7 hours. Eight parties can work at once, so 16 men should complete in 7 hours.

If sufficient men are available, (*b*) can be commenced very shortly after (*a*) and the two operations then proceed concurrently. In the same way, (*c*) can be put in hand when (*b*) is half finished, and much of (*d*) can also run concurrently with the other operations; (*e*) must be carried out after the completion of the other work, but is unnecessary unless the bridge is to be used for animals.

From the above it is calculated that about 150 men could prepare their material and erect the above bridge in 35 working hours.

For the sake of clearness, Photo No. 1 was taken *prior* to placing handrails and steadying guys, which are, of course, as necessary for this bridge as for any other. These are shown finally fixed in Photos Nos. 2 and 3, where mules and a cart may be seen crossing the bridge. Both handrails and steadying guys are small cables made from split bamboo in much the same way as the cables carrying the roadway. As, however, great strength is not essential for these, they can be made from the waste segments (A and D, *vide Fig.* 1), bound together as before with wire or twine. The handrail cables are passed over rough props about 3′ high at each end of the bridge to raise them above the roadway, hung at about the same "dip" as the main cables, and then connected with the latter by lattice work of waste pieces of bamboo, bound on with spun yarn, twine, grass fibre, or anything available.

As regards the uses of this type of bridge, it is not contended that bamboo cables would be used were any others to be had, or that a hurdle roadway would be laid were chesses procurable. As, however, by the above method a large span bridge *can* be erected in a bamboo-producing country with no imported stores beyond a certain number of small lashings and some balls of twine, a knowledge of its practicability may possibly prove of value.

NOTE.—Since writing the above article, the bridge in question was tested to destruction by piling a concentrated load on the centre till failure resulted. This took place after a little more than 12,000 lbs. had been so placed, and occurred (as was anticipated) in the cable

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whose "slats" had been connected end to end with twine, these joints tearing out here and there throughout the cable.

The other cable, whose "slats" were connected end to end with wire, remained unaffected.

As 12,000 lbs. concentrated at the centre is roughly equivalent to a distributed load of infantry in Single file (for which the bridge was calculated), the Factor of Safety allowed of 3 was none too much *for twine joints.*

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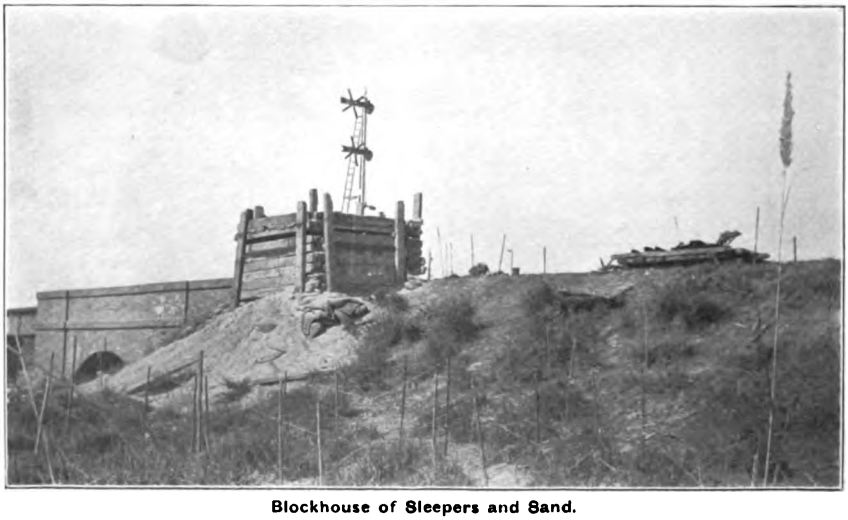
THE OUDH AND ROHILKHAND RAILWAY VOLUNTEER RIFLES.

Volunteers' Portion of the Gumti Bridge, Lucknow Brigade Manœuvres.

Part of the Volunteers' Trench, Lucknow Brigade Manœuvres.



Blockhouse of Sleepers and Sand.

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THE OUDH AND ROHILKHAND RAILWAY VOLUNTEER RIFLES.

By THEIR COMMANDANT.

ALTHOUGH by title "Volunteer Rifles," a short account of the year's doings of a corps of railway men will probably not be without interest to some of the readers of the *R.E. Journal*. The Indian Railway Volunteers already number many Royal Engineers amongst their officers, and it is heartily to be wished that every Sapper who takes up railways as his "special" line, would do his share in helping the Volunteers of the railway to which he, for the time being, belongs.

Volunteering in India, even if it has hardly made the same strides towards efficiency that the sister service in England seems to have done of recent years, has notwithstanding made considerable progress; and we have advanced a long way from the days when the whole of the totally inadequate time available of the men was expended in vain endeavours to secure clockwork precision in a few more or less useless parade movements, when the camps of exercise were chiefly picnics in the headquarter stations, and police took over guard duties at nightfall!

Progress took a definite shape towards the close of Lord Kitchener's term as Commander-in-Chief in India, when special instructions were issued from Army Headquarters for the training of Volunteers in India. These instructions laid stress on the uselessness of attempting to compete with Regulars in ceremonial movements, and on the importance of training the men in practical measures, more especially for the defence of posts, or such military work for which the civil duties of the men happened to give them special aptitude.

These instructions the Oudh and Rohilkhand Corps had been gradually anticipating for some years past under its late commandant, Lieut.-Colonel Cardew, V.D., and adjutant, Capt. Darley, of the 81st Pioneers; and when the present commandant took over officiating command, all was ripe for a whole-hearted acceptance of the spirit of the new instructions that came out a few months later.

Just over a year ago the corps went into its 1909 camp of exercise at Mohanlalganj, 13 miles from Lucknow. Every European and Eurasian employé of the railway as a condition of his agreement of service undertakes to maintain himself as an efficient Volunteer; and in this way, while it is no more correct to describe them as

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"conscripts" than any other body of men bound for military service for a term of years, it is obvious that in the Indian Railway Corps the Empire has the makings of an extremely valuable asset. Under these conditions the strength of the Oudh and Rohilkhand Corps fluctuates between about 575 and 625 men according to whether times are good or bad on the railway, and whether the "powers that be" favour European or Indian labour. But since it is not practicable to check the work of the line for a week, and as moreover the camps of exercise are necessarily at rather a busy time of the railway year, some 200 to 250 are all that can be got together for any one camp.

The first two days at Mohanlalganj were devoted to close order drill to get the men together, after that, while the early mornings were devoted to drill, from 11 o'clock onwards to dusk was taken up by practical schemes based on the supposition of the existence of a state of rebellion, and also largely by railway problems.

Thus one day a party of Volunteers, cut off at an outstation with the railway destroyed, were given the task of escorting some bullock carts supposed to contain women and children into Lucknow.

For the next scheme Lucknow was supposed to have fallen into the hands of the rebels and to be undergoing a siege. An armoured train had emerged from the town and damaged the besieger's parks. The Railway Volunteers were told off to get as close to Lucknow as they could and blow up the track. Explosives had very kindly been supplied for the purpose by the Sappers and Miners at Roorkee, and a length of track had been specially laid for demolition purposes close alongside the real main line of which it was supposed to form a part. This special track was duly blown up by instructional parties of Volunteer officers, while the men received instruction in outposts; the outposts performing the practical duty of keeping a cordon round the site of the explosions.

For the next scheme, news was supposed to have reached the "refugees" of the first day's scheme, that their entrance to Lucknow had been barred by the rebels and they had to prepare themselves for a defence pending the arrival of assistance from inside Lucknow.

A site was selected giving opportunities for different classes of work, the defensive line being composed partly of stockading of old wooden sleepers on edge, with earth between the two "skins" of sleepers, and partly by aloe fence placed in a state of defence, or by trench work. In addition flares, fired either by automatic trip wires or by an electric exploder, were placed outside the perimeter.

On the final day the General Officer Commanding, Lucknow, held his inspection of both the Lucknow Volunteer Rifles and the Oudh and Rohilkhand Railway Volunteers. The Oudh and Rohilkhand men formed part of a force besieging Lucknow, while the Lucknow Volunteers formed part of the Lucknow garrison. "Lucknow" was supposed to have blown up the track at the spot where the railway

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men had carried out their demolitions two days previously; and to the railway men now fell the lot of repairing the track, while the Lucknow men's task was to prevent the operation.

The Railway Volunteers had what was, alas, only a sham armoured train, with beautifully loopholed sides but only of wood; and with this they ran out as a repair train, unloaded their materials and repaired the line with a working party of 1 officer and 10 men, while the balance of the corps formed the covering party. An interesting little fight took place between the two Volunteer corps, but the Railway Volunteers finished their task satisfactorily after just one hour's work.

At 9.30 p.m. the defences prepared the previous day were occupied as a bivouac, and shortly afterwards the automatic flares went off, exposing targets that had been put up to illustrate the effect of the bonfires in assisting night firing; successive lines of flares were ignited, two automatically and a third electrically, following up the supposed attack; and finally the electric explosion of a "mine" (represented by a guncotton slab) ended the night's proceedings.

The next day the corps did its first real march, covering the 13 miles into Lucknow in good time and style and with practically no casualties. The only two men who fell out, did so on account of sore feet of some days' standing. In a country where men walk but little, it was not an unsatisfactory performance especially as, by the middle of February, the sun is hot and the way dusty.

All through the hot weather and rains in India little instructional soldiering in the field, beyond musketry in the early mornings, is possible, but during the past year this was not the entire sum total of the useful work done, for weekly lectures on simple tactics were instituted for the officers, and were well attended throughout not only by the railway men, but also by the officers of the two other corps in Lucknow, and even by occasional visitors. Field Regulations were worked through, and a few simple schemes solved, and on two occasions officers of the Brigade Staff gave lectures which were very much appreciated.

The hot weather had barely ended when opportunity was taken of a brigade route march, to commence a closer alliance with the Regulars by taking part in the march along with them.

When the cold weather returned the "Instructions for Training" had been received giving official sanction to the lines on which we had been working, and after two or three company drills, digging practice was substituted at the weekly parades, and an outpost position entrenched, which when ready was attacked by the Lucknow Volunteers, (who had also done their share of the work in the trenches). After this the Oudh Squadron of the United Provinces Horse held their camp, and at their request a field day was held, the combined Volunteers of Lucknow—viz., the Oudh Squadron, the

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Lucknow Volunteers, and the Oudh and Rohilkhand Volunteers—attacking successfully a line of communications which was held by two double companies of the 8th Rajputs.

Finally, after some more weekly parades for ordinary drill, the Corps took on the construction of a blockhouse to cover one abutment of a bridge over the Gumti River. The result, (which with its railway signals close behind the blockhouse bears a curious resemblance to the sketch in the textbook), is shown in one of the accompanying prints, and withstood rifle bullets fired into it at the closest range. When completed a small skirmish illustrated to the men the effects of loopholes both for firing out of, and against.

The Lucknow Brigade had now gone out for its annual training 9 miles from Lucknow, and on the 8th January the Railway Corps, with a small party of Volunteers from the Lucknow Corps, altogether some 200 strong, marched out to join them. That day and the next,—being Sunday,—we were left to ourselves except for joining the brigade at Divine service, upon the conclusion of which the G.O.C. Brigade presented certain Volunteer decorations and medals.

On Monday the fun began, and at 9 a.m. the Volunteer rendezvous was on the right of the brigade and they helped in driving a skeleton hostile rear guard towards the Gumti River. The skeleton was mostly of cavalry, and the flanks found plenty to keep them interested. After some hours of this the whole brigade "went over to the enemy" to help them entrench a position. Part of the railway men's trench, which came in for special commendation from the G.O.C., is shown in one of the photographs.

Next day a more substantial foe was ensconced in these trenches, where they were attacked by the rest of the brigade. The Volunteers started on the right flank until the enemy had been definitely located, then guarded the left of a flank march round the enemy's left, and finally followed up as a rear guard; in which latter capacity they kept up an exciting fight for some distance against a hostile squadron which finally charged without success, and was then sent about its business elsewhere.

On the third day work was started on a trestle bridge to be thrown over the Gumti two days later; and a working party of 50 Volunteers and 50 Regulars prepared the 13 trestles that comprised the bridge. To the remainder of the Volunteers were allotted the task in conjunction with two squadrons cavalry and two guns of forming a skeleton rear guard against the brigade. Successive positions were taken up and the fight kept going for some hours.

Next day we had field firing, in which both the artillery and infantry took part; the latter with their machine guns in battery. Some 80 of the Lucknow Volunteers marched out over-night and were put up in the railway men's camp to take part in this day's work, which was as realistic as possible the artillery during part of

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the time firing over the heads of the infantry. The targets of chatties and falling plates represented three successive lines of defence, the first being the trenches of Monday; and the last line was carried by a bayonet charge.

After this the whole, with the exception of the Martiniere Boys, went into bivouac, and the Railway Volunteers set to work to cover the frontage of the bivouac outpost line with a line of bonfire flares, alternately automatic and controlled. The flares were purposely ignited by a large variety of means, some being by sandbag drop weights driving a nail into a cartridge, some by rifles with the fuze inserted into the cartridge case, some by artillery friction tubes into which the core of instantaneous fuze had been inserted, some by native "chiraghs," or lamps, at the end of a lever buried in a decked pit. For these latter the bonfire is partly built over the decking, and, on pulling a wire, the lamp lifts into contact with straw, etc., sticking down into the pit between the bars of the decking. Others were fired by electric exploders. As in the previous year the corps was indebted to the Sappers and Miners at Roorkee for much of the stuff employed.

After nightfall the bivouac was attacked by the 74th Punjabis, and a very good idea was obtained of the effect of the flares. They appeared to be a good deal too close together, the glare being excessive except away to the flanks where the country was well lit up for a considerable distance. The bonfires, some of which burnt brightly for 20 minutes or more, were spaced 100 yards apart; but as only some of the automatics were tripped, (the attack being on one flank of the line) the remaining (controlled) flares were, over the greater part of the frontage, 200 yards apart. Three hundred yards apart would probably have been ample, even allowing for some failures. There were only two failures on this occasion out of the whole lot. Two "electrics" on one circuit went wrong, and the attack started before the fault (which had been discovered in testing) could be located and remedied.

Bivouacking, like the 13-mile march of the previous camp, was a new experience for the Volunteers, and had been somewhat feared by the older hands; but the new adjutant, Capt. Hutchinson, also a pioneer, had made good provision for their comfort; and with bamboos and string and railway tarpaulins, *tent d'abris* were fixed up and enabled a comfortable enough night to be passed.

Early next morning a start was made in pursuit of our enemies of the night attack, and they were soon found to be holding a ferry near by, and were driven across the Gumti, after which the construction of the trestle bridge was started. The first three spans made by the railway men are shown in the third photograph. When these had been finished turns at building were taken for instructional and inspection purposes by each of the British regiments and the 8th Rajputs.

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This ended the work of the camp for the Volunteers, and on the next day they returned to Lucknow. They had met every possible kindness from the brigade, and special care seemed to have been taken that they should each day have plenty of really interesting work; and the hope that the General expressed that he would see them again in camp next year is only likely to be frustrated by his just having been promoted to a more important command.

It is hoped that the above account shows that some really useful work is being done among Volunteers in India. If it induces any of our young officers who mean to join "railways" on coming out to India, to also take up "volunteering" keenly from the first, it will have served a useful purpose. Without doubt there are many things that might be improved, but even as it is the Railway Volunteers form a corps to which Royal Engineers may well be proud to belong.

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TWO UNPUBLISHED LETTERS OF THE LATE MAJOR-GENERAL C. G. GORDON, C.B.

THE following letters were written to the D.A.G., R.E., by the late Major-General C. G. Gordon, C.B., R.E., whilst in command of the "Ever victorious" army in China in 1863. They were recently brought to light and have been sent to Chatham for inclusion with the other Gordon relics in the R.E. Museum.

As however they are of special interest, and give an excellent description of the difficulties which he had to encounter with the ill-disciplined Chinese troops under his command, they are published in the *Journal*.

———

7th March, 1863.

MY DEAR COLONEL,

Very many thanks for your last kind letter and for your kind wishes. I had intended writing you a long letter this mail but have had too much to do. I will however write at length next mail D.V. and give you all details. I have not written to thank Colonel Gordon, but will do so by the next opportunity. I believe the General will put me in command of Ward's force when he returns from Hongkong in 10 days, Mr. Bruce having approved of the same; this however is of course subject to the Duke's and your approval. The fleet is to rendezvous at Yokohama in April to demand reparation for Richardson's murder. If possible, I want to get Sanford here, but I will write more fully next mail when the conditions are settled. War with Japan is merely a question of time I am sure. I have all the plans, etc., ready of the principal towns, etc. The first battle will be serious but after that I do not apprehend they will again meet us. Good-bye and kind regards to Colonel Keane.

Yours very truly,
C. G. GORDON.

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HEADQUARTERS, QUINSAN,
16th July, 1863.

MY DEAR COLONEL,

Very many thanks for your letter of the 25th May. * * * * I hope you do not think I have a magnificent army. You never did see such a rabble as it was, and altho' I think I have improved it, it is still sadly wanting. The decision of the War Office that officers are to go on half-pay if serving out of the radius, has taken two officers from me, and cholera took my best officer (Cookesley) only yesterday. I have now only ——, an Assistant Surgeon but very good man, and ——, who is an old 67 man, and only good for Garrison duty. The officers I have no reason to complain of. I have had battles enough with them, but they are now subdued, ditto the men, and I think both like and have confidence in me, but with all this they are not in anyways companions, or very much to be trusted. I have no sinecure, having the payment responsibility with a very unsatisfactory paying treasury who look to every dollar, Mandarin intrigues and jealousies to combat, no interpreters except pidgin English ones, who are not to be trusted, and not a very great supporter in General —— who talks immensely but does very little. In spite of what you may think about my saying so, I really am the only stay of this force and on my life hinges its existence, and not only that, but now the English garrison is so diminished, there is nothing but this force to keep the rebels out of the thirty-mile Radius: however thank God I am well and not downhearted although I do feel very anxious at times. When Sherard Osborne comes, I shall have some support from him, but not very much as his force cannot penetrate the country. I now occupy a most commanding position with respect to the Rebels, being able to attack them along a very wide front; but then they have nearly 50,000 men in Soutchow and I have 3,000 and 3 steamers, of which I have to leave 1,000 to garrison this place if I go out, so you see I am not very comfortably situated altogether. We did give the rebels a tremendous defeat here, they lost nearly 6,000 killed and we took over 1,000 Prisoners, losing on our side 2 men killed and 5 wounded. You can imagine what the effect of a 32-pr. playing into a mass of troops for upwards of 14 hours with grape canister and shell at distances varying from 50 to 200 yards, the road being so narrow that only two could go abreast and so located that they could not leave it without going into water out of their depth. The Steamer kept just in their rear. It was very awful this waste of life, but altho at times I was loath to fire I did so, as the Rebels had never had a good lesson before. I send you hand sketches and ask you to excuse my not having written before. I have had to see even to the daily issue of Rations to the

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troops, and am even now obliged to look to every minutiæ of the Artillery. All the Commanding Officers of Regiments resigned the night before we were to start for Quinsan, because I would not give them higher rank and pay, but I did not care, and altho the men refused to move the next morning, I made them go, and left the disconsolate majors behind: they then came and begged mercy which however I did not grant. This was a nice state of affairs. When we took this place and I changed our Headquarters 1,300 men left, and I had only 1,700 men, but those inclined to mutiny. However the summary execution of a ringleader stopped them, and I can say now that both officers and men altho ragged and slightly disreputable are in capital order and well disposed. So you may see, my dear Colonel, there is some excuse for my not writing to you and to other old friends who have done so much for me. We have now 3 steamers, a heavy Siege and Field Artillery and about 3,000 men, and know something about the country which is worth 5,000 men more. I would like to go into details of our Attacks but the heat and work prevent me from so doing. I therefore content myself with showing our position by map.* Sanford† would be worth any money out here, but I am so uncertain about money affairs that I dare not write to him to come out. You may rely on Sanford being a capital officer fit for any duty, with a capital head and experience of a man of 35; I would not mind serving under him, so highly do I think of him.

Sherard Osborne has not yet arrived, he will find very great difficulties to contend with as the Mandarins do not care about him over much, and think they can put down the Rebellion without him. You can see by my map how hemmed in the Changhusses are. The Governor of the Province never interferes with the operations, he leaves it all to me and I am therefore enabled to make attacks at any time. I wish I had time to copy the Mandarins' letters I get, some of them are very amusing. The Rebels are now very much better armed than when we met them last year, they have even Deane and Adams revolving Rifles and heaps of muskets, but no Field Artillery. I used Rockets against them, which they did not like at all, the Prisoners said that the soldiers used to go about holding their noses, as they thought the smoke would poison them. It is quite another affair fighting them with Chinese troops, they do not hesitate to attack at night, which is always irritating with any troops, but very bad with Chinamen. We hope D.V. to take Wokong, a walled city south of Soutchow about 12 miles, in about a fortnight, and from this to get the command of the Taho Lake and thus cut Soutchow off from the South and surround it on three sides. Our next move will be

* Owing to the cost involved, these maps are not reproduced in facsimile.

† Afterwards Lieut.-General G. E. L. Sanford, C.B., C.S.I.

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Woosich, North of Soutchow which will complete the circuit, and cut Soutchow off from Nanking. If it does not then fall we must attack it, but this I am anxious not to do as it is 12 miles round its walls and has a very large garrison with but little rice and for me to plunge into that city with 2,000 men would be to run the risk of a serious reverse with nothing to fall back upon. The Rebels are in a great state, and are afraid to come in for fear of their men deserting, which they would do, as they know we did not kill any of the prisoners we took. I have some of these latter in my Bodyguard, they went to fight their old friends about a week after they joined me, and did pretty well. The prisoners tell such extraordinary stories of the proceedings of their Wangs or Kings. The great thing in taking stockades from them is to cut off their retreat, and the chances are they will go without trouble, but attack them in front and leave their rear open, and they will fight most desperately. I am in hopes to be able at some future time to draw up a report on the late operations which I will send you, but you must not be hard on me now, I have no A.D.C. and have everything in the writing way to do myself.

How is Simmons ? I have never heard from him. General Stavely was the man for China, if he had kept his health, he had a better eye for country, and hit the weak spots better than anyone I knew, and he thoroughly understood a plan or sketch, which some men do not. This is indispensable for this sort of fighting as the Chinese are most untrustworthy guides.

Believe me, my dear Colonel, with kind regards to all my kind friends and hopes that I may correspond in future more regularly,

Yours truly,

C. G. GORDON.

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WORKS FOR THE TRAINING AND CONTROL OF RIVERS.

By LIEUT. W. HYDE KELLY, R.E.

INTRODUCTORY.

WORKS for the training and control of rivers divide themselves into two distinct classes—(A) those for the improvement of a river for navigation purposes, and (B) those for checking floods, preventing droughts, or for irrigation. Those of Class A deal principally with the estuary of a river, while Class B works deal with weirs, embankments or locks.

In either class, where the river is of any size, the works are of State importance, and in such countries as India and Egypt they are entrusted to State Departments. They form a branch of engineering in which R.E. officers have, at various times, played a most important part. The pioneers of river engineering in Egypt and India were R.E. officers, and the names of Sir Arthur Cotton, Sir Colin Scott-Moncrieff, and Sir R. H. Brown readily occur to the mind in connection with the great irrigation work in those countries. The works recently carried out on the Nile are already proving how valuable they can be to Egypt; and in America, the works for the prevention of floods along the banks of the Mississipi and for the improvement of its navigable waterway are on a colossal scale, but are also productive of even greater benefits.

In South Africa, where such large rivers as the Orange and the Vaal are nearly dry at some places in the dry season, irrigation works and storage reservoirs would be of incalculable value to the Colonies. Where such works have been carried out on an infinitesimal scale, the increase in the productive powers of the neighbouring land has been remarkable.

The treatment of a river first of all requires an intimate knowledge of its previous history and behaviour under normal and abnormal conditions; a minute survey of its bed and of the sea floor over which it discharges itself; an accurate record of its tides, if it be a tidal river; of its floods; of the neighbouring sea coast, and the prevailing winds, littoral drift, etc. The rainfall over the river basin must be studied, and also its geological formations. Like all important engineering problems, river works need especial study.

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(A). WORKS FOR THE IMPROVEMENT OF ESTUARIES.

The estuary of a river is well described as covering the region inland affected by the sea, and the region seaward affected by the river.—(Cunningham).

The improvement of estuaries is a subject which plays a very important part in the world's development, and many examples can be quoted to illustrate the remarkable change that has taken place in different quarters of the globe as a result of improvements in the great rivers. Many a port would have subsided into insignificance when ships of iron and steel took the place of the old wooden hulks, if it had not been for the assistance of the engineer.

The obstacles which river works design to reduce or remove are the results of a great many years' work by nature uncontrolled, and hence the improvements effected by the training of the river require a considerable time to develop. This makes it all the more necessary for the engineer to look well ahead and weigh the effect his works will have in some five or ten years' time.

There is, even to-day, much discussion among engineers as to the explanation of nearly all the phenomena connected with rivers. But although several matters regarding the formation of bars, the shifting of channels, and the effects of wind and waves, are still unsettled, the general principles are fully acknowledged. Improvements in submarine survey and the lessons to be learnt from former works are now leading to a clearer understanding of rivers.

Transporting Power of Rivers.

All rivers carry with them material which they have eroded from their banks or which has been poured into them by floods. The quantity of matter carried along varies very much, but it is always immense, as the following examples show :—

(*a*). The Mississipi discharges annually into the Gulf of Mexico 777,805,550,000 cubic yards of solid matter, increasing its delta by over a square mile per annum.

(*b*). The Ganges, in the rainy season, carries 300,000,000 tons of solid matter a day.

(*c*). The Thames deposits 500,000 tons a year in the sea.

(*d*). The muddy colour of the Amazon can be observed at 300 miles distance from the mouth.

This capacity for carrying material depends on the velocity of the river, and when the water is heavily loaded there is always a tendency for the suspended material to be deposited when the velocity receives a check either from the opposition of the tides or from the slackening of the velocity due to a wide extension of the surface. Thus, at river mouths the down-flowing water meets with considerable opposition

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when it encounters the sea, and in tideless seas the sediment in the water is deposited freely and continuously, while in tidal seas the deposit still takes place but is subject to a variety of disturbing influences.

Rivers discharging into tideless seas are conspicuous for their large "deltas," always increasing, and over which the river finds outlets wherever it can, *e.g.*, the Nile, the Danube, the Rhone, the Mississipi.

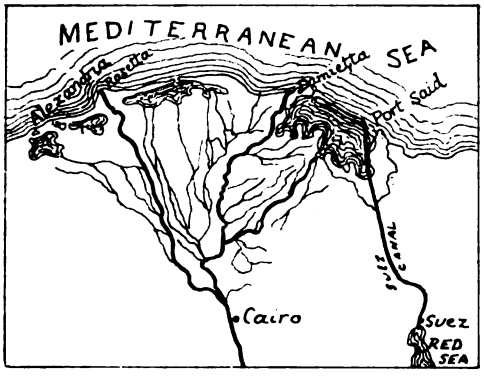

FIG. 1.—*Delta of the Nile.*

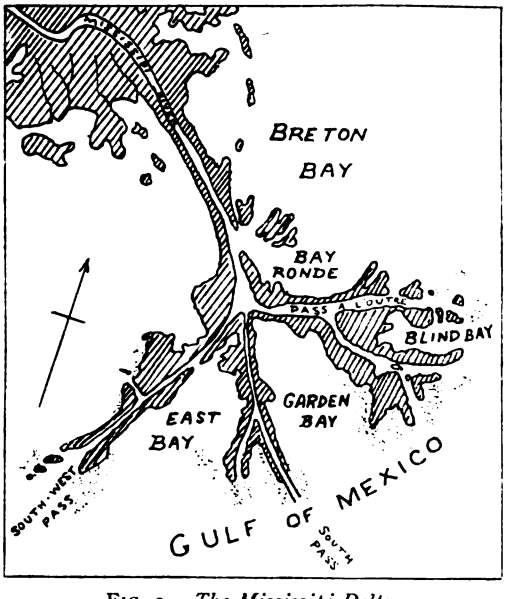

FIG. 2.—*The Mississipi Delta.*

In a tidal river, there is a constant struggle going on between the river forces and the sea forces. The water flowing downwards by the river is dammed back by the incoming tide, and a great accumulation of water takes place, which, when set free by the turn of the tide, flows to the sea with much greater momentum and carries the

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sediment to a much greater distance out than would be the case with a tideless river. The deposit, in some cases, takes place far beyond the limits of the estuary. This increased volume of water also tends to enlarge the bed of the river towards the sea. But if these influences were the only ones at work, the river would be constantly in a navigable state, and nature would not require to be interfered with. There are, however, other influences to be considered, such as littoral drift, prevailing winds, local currents, etc., all of which have their effect on the river bed.

TREATMENT OF TIDELESS RIVERS.

There are several very large rivers which discharge into seas which are practically tideless, *e.g.*:—The Volga, into the Caspian; the Danube, into the Black Sea; the Mississipi into the Gulf of Mexico; the Rhone into the Mediterranean.

This class of river is the most unsuited for navigation. It is in most cases hampered by its low-lying delta. It finds its way to the sea by several shallow channels which are constantly changing their positions. As soon as the sediment chokes up one channel, another is formed, and the delta is pushed further out to sea every year. (The rate of increase of the Danube delta before training works were begun was about 200′ a year.—[Vernon-Harcourt]).

There are three general methods of improving tideless rivers:—

(*a*). Training walls, embankments or dykes.
(*b*). Dredging.
(*c*). Lateral canals.

(*a*). *Training Walls, or Dykes.*—These are built with a view to confining the main stream of the river within defined limits, and directing its full energy through one outlet. This confinement of the stream increases its energy and helps to deepen the channel by scouring, and to wear down the obstructing accumulation at the outlet.

As the removal or reduction of the bar is the chief object of the training works, the walls, piers or jetties, must often be prolonged far beyond the actual mouth of the river, for some bars are a considerable distance out. Training walls that are not carried far enough are likely to cause another bar to appear in another place. But it is not necessary that the works should start inside the estuary above the mouth, for some rivers have great depths inside their bars.

Every case must be treated on its own merits, and no hard and fast rule can be laid down. Some jetties have been laid parallel; others convergent; and some again divergent. Some are built to project above high water, others are kept below low water.—(Cunningham). But the latter are somewhat dangerous to navigation.

Again, the works may consist of open timberwork; framed piles;

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mounds of chalk, stone or earth ; concrete blocks ; fascines or mattresses of osiers sunk with stones or loaded with clay. (The latter method has been much used in Holland, the Lincolnshire Fen Country, and on the Mississipi). These works require a vast amount of material, and the best possible use of suitable materials at hand must therefore be made.

Ironwork is not as a rule used, owing to the corrosive action of the salt water. Timberwork does not suffer nearly to the same extent, as the marine growths, barnacles, etc., soon protect it.

Continuous mounds of chalk, stone, or earth faced with stone, are cheap and do not require much maintenance, but they are slow to build, and where strong winds prevail, the facing of the banks must be of stone or concrete, and a good apron of concrete should be laid to protect the bank from the impact of waves. The silt brought up by dredgers has been used for filling at the back of training walls.

Various sections of training walls are shown in the following (*Figs.* 3, 4, 5 and 6) :—

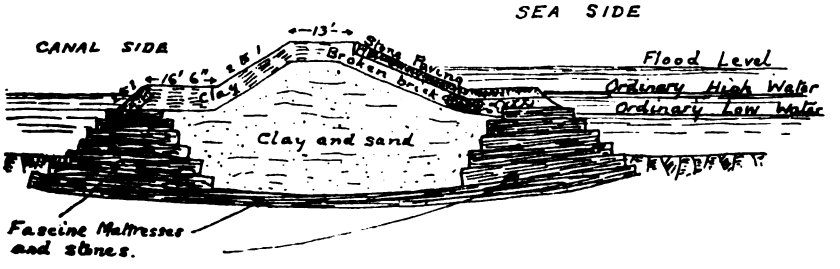

FIG. 3.—*Dutch Canal Bank.*

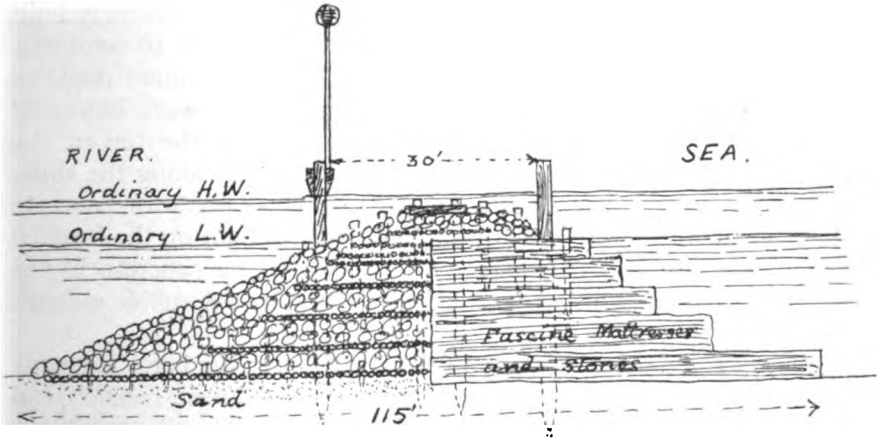

FIG. 4.—*Jetty at Hook of Holland.*

The principal advantage claimed for the training wall system is that once the walls are built and have directed the river, nature will maintain the improvement. This is not always the result. Sooner

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or later the bar reappears; but it may be again removed by a prolongation of the walls, and the deposit carried still further out into deep water.

Training walls have been very successful in numerous cases, and they are the most usual works employed.

Examples of Training Walls.—(i.). The Dutch, the greater part of whose country depends upon their dykes, are forced to use fascines made of osiers as foundations for their dykes or embankments. There is an absence of stone and timber in Holland, but osiers are extensively cultivated for the dykes, and large "mattresses" are made of the fascines, and sunk in position with bricks or clay. For sandy bottoms, they are admirable as foundations for the embankments.

(ii.). *The Danube Mouths.*—This great river, 1,725 miles long, flows with a channel 1,700′ wide and 50′ deep to a point 60 miles from the Black Sea, into which it discharges. But from that point the river breaks up into a number of shallow branches flowing over a large delta. There are three chief branches, the Kilia, the Sulina and the St. George's. About 1853, plans were made for the improvement of one of these branches into a permanent navigable channel, and the Sulina arm was chosen. It already had a navigable mouth and a comparatively slight bar; there was also a strong littoral current which helped to sweep away detritus from the mouth. So that its improvement was expected to be easy.

Work was begun in 1858, and two jetties were run out from the shore on each side of the mouth, extending out to the bar. The jetties are convergent for the first part of their length, then parallel and finally slightly divergent. At the "neck" they are 600′ apart. They were built of a rubble mound and piling surmounted by a timber platform 14′ wide, strengthened at intervals by strongly built cribs of the same width. The work took three years to complete, and a marked improvement was soon noticed, a minimum depth of 16½′ and width of 500′ being obtained. The jetties were improved and strengthened in 1868, by a concrete wall on the top of the mound, made by depositing cases of concrete *in situ* along the shore ends of the piers. Along the outer portion, a wall of 18-ton concrete blocks cemented together by concrete filling was built on the levelled rubble base, and the outer slope was protected by concrete blocks weighing 10 to 20 tons, deposited at random on the rubble mounds (see *Figs.* 5, 6 and 7).

In 1873 there was a minimum depth of 20′ over the bar. But now the limit of the scouring capacity of the stream had been reached, and the deepening of the channel ceased. Ships went on increasing in size, and soon there were a number of vessels that could not enter the Danube. (In 1893 there were 336 of such ships). Recourse was then had to dredging and a powerful dredger set to work in 1894. At the end of 1895 a ruling depth of 24′ had been obtained and this is still being maintained.

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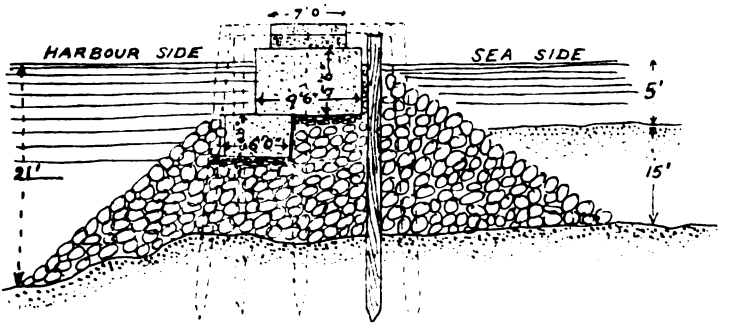

FIG. 5.—*Section of South Jetty.*

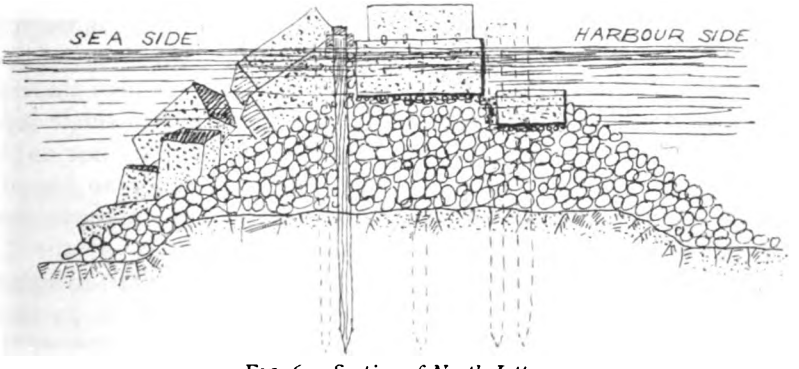

FIG. 6.—*Section of North Jetty.*

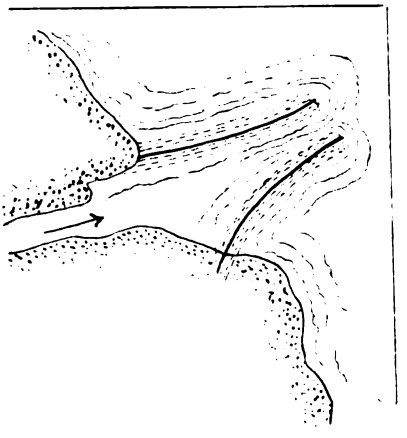

FIG. 7.—*Plan of Jetties at Sulina Mouth.*

The interesting point in the Danube works is the limitation of the natural capabilities of the Sulina stream to maintain its channel at 20′ depth. This practically limits the useful employment of jetty training works, and there is good reason to suppose that such a limit may be reached in other rivers. The depth beyond which the stream will not scour its channel, will not of course be the same in every case.

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(iii.). *The Mississipi.*—This huge river, 4,500 miles long, and having a basin of 1,244,000 square miles, has proved a very interesting example of the improvement which may be effected by engineering.

The Gulf of Mexico, into which the river flows, is practically tideless, having a rise of only 14″, and there is only one tide a day along the face of the Mississipi delta. The delta has an area of 12,300 square miles, and the river has three principal arms, called "Passes," which have altogether seven mouths. The Passes are the Pass à l'Outre, the South-West Pass, and the South Pass. The two former carry about 45 per cent. each of the total discharge. There were bars blocking all the channels.

The earliest attempts at improvement were made in 1826, when primitive harrows were dragged backwards and forwards through the sand in the hope that the current would carry the stirred-up sediment further out to sea. This was naturally a slow and very imperfect process, and in 1837 some attempts were made with a single ladder dredger. But storms caused the channels to fill up as fast as they were cleared. Several schemes were propounded for an improvement, but nothing was done—chiefly owing to a lack of funds—until 1874 when a very enterprising engineer, Capt. Eads, of the U.S. Engineers, undertook to create and maintain a channel through the bar of the South-West Pass with a minimum depth of 28′ by means of parallel jetties. He offered to carry out the work without payment unless it was successful.

The Government, after much opposition, eventually accepted the offer, but insisted that the South, and not the South-West, Pass should be treated; also that the minimum depth over the bar should be 30′. Eads took the work in hand.

The Pass had a width of 600′ to 800′ and a minimum depth of 25′ throughout its course of 13 miles, except for ½ mile at the junction with the main river, where it had a depth of only 15′, and at the mouth, where there was only 8′. The jetties were carried out in prolongation of the natural banks of the Pass, and across the bar, for a distance of 2¾ miles. They were built of fascine "mattresses," made of willow; each mattress being 100′ long, and 2′ thick, varying from 40′ wide at the bottom to 20′ at the top of the bank, after the old Dutch fashion. The distance apart of the jetties was 1,000′. To protect the jetties from scour, the inner portions were covered with a layer of rubble stone at the top, and the outer portions have large concrete blocks for a distance of 1 mile along the east jetty, and about ½ mile along the west jetty. These blocks vary in size towards the sea end, from 3′ 6″ × 3′ × 16′ to 13′ × 5′ × 55′, the last weighing over 260 tons. The jetties are raised above flood-tide level, except the last 1,000′.

The result of these works was the rapid improvement of the channel to more than the stipulated width and depth, and this has since been

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maintained by the natural scour of the river.—(Cunningham; Vernon-Harcourt).

It is a splendid example of the value of training jetties properly placed (see *Figs.* 8, 9 and 10).

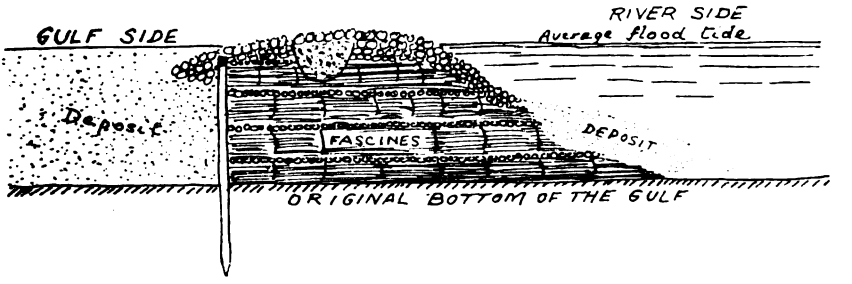

FIG. 8.—*Fascine Wall of Mississipi.*

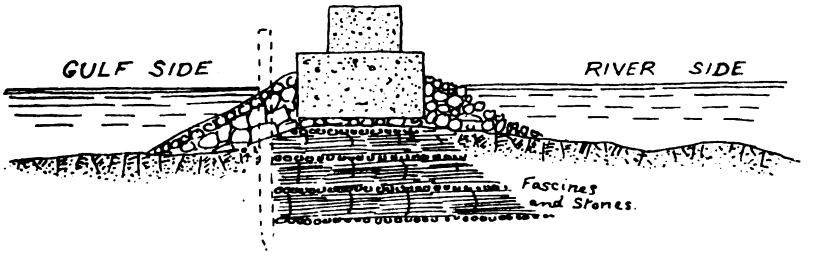

FIG. 9.—*Section of South Pass Jetty.*

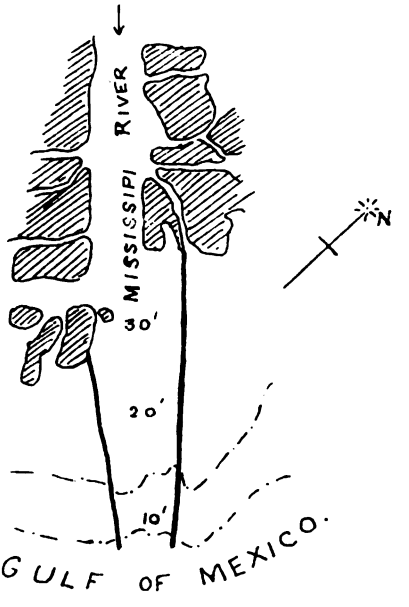

FIG. 10.—*Plan of Jetties at the South-West Pass.*

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(*b*). *Dredging.*—This can only be a temporary means of improving the estuary. The amount of deposit removed by the dredger is comparatively small compared with the amount which may be removed by the scouring power of the river, and dredging by itself merely removes a portion which may be rapidly replaced.

It is, however, a less expensive and quicker method of improving an estuary, while the cost is recurring—the reverse of the case with training works.

There are several instances where dredging has proved very successful, *e.g.*, on the Mersey ; and it has also been employed as an adjunct to training walls, where the channel scooped out by the dredger is maintained and enlarged by the stream itself. Dredging and training walls have been employed together on the Danube and Mississipi.

There has lately been a great improvement in dredgers, and powerful suction is now employed instead of the older and more cumbrous method of bucket dredging. The latest dredger is a huge vessel, the *Leviathan*, built for the Mersey authorities and launched October, 1908. She is capable of carrying 10,000 tons of sand, and has a length of 487′, and a depth of 30′ 7″. She has pumps capable of dredging the 10,000 tons of sand in 50 minutes from a depth of 70′, and when fully loaded, she can steam at 10 knots. She has a mean draught of 23′ when loaded.

(*c*). *Lateral Canals.*—This method is not much used now. Formerly it was very commonly adopted. Its chief drawback is that it abandons the natural bed of the river. The canal has to start above the delta, and enter the sea clear of the delta area. This means a series of locks, and the accompanying loss of time for traffic. The mouth of the canal itself has to be kept clear of sediment by dredging.

Treatment of Tidal Estuaries.

There is a broad distinction between tidal and tideless rivers. The latter have usually a considerable delta and a number of outlets into the sea. The former have usually a single channel, expanding, as it approaches the sea, into a broad estuary.

Most tidal rivers are troubled with bars, but they are not formed in the same way as bars in tideless rivers. There is a constant disturbance of the tendency to deposit, and the sediment carried down by the river becomes more or less uniformly deposited throughout the estuary. But the sea in certain places tends to accumulate material along the shore, causing a continual advance of the coast line while it is elsewhere eroding it. This accumulation, when carried on across a river mouth, is interfered with by the scouring action of the tides, until at last a state of equilibrium is reached, and the deposit is kept at a fairly uniform level. Wind and waves also assist the movement of deposit along the shore.

In some cases, where this silting action tends obliquely across a

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river mouth, the natural outlet of the stream may become completely blocked, and the river course diverted, as in the cases of the Yare, and the Adur (in Sussex).

An estuary may be funnel shaped or bottle necked. The Thames and Severn are examples of the former; the Mersey an instance of the latter. The funnel-shaped estuary is less likely to have a bar than the bottle necked. The Severn has no bar, and the Thames, although it has a slight bar and shifting channels, has a navigable waterway out to sea; but the Mersey has a very serious bar, and the Tay has two.

The funnel-shaped estuary allows the tidal flow to penetrate higher up the river, thereby increasing the volume of water returning with the ebb. But there must not be too sudden an enlargement of the mouth or the flow will not prevent silting, *e.g.*, the Seine.—(Cunningham).

A bottle-necked estuary, by offering obstruction to the tidal flow, loses the chief advantage of a tidal river, and shoaling takes place inside the estuary.

"The objects to be aimed at in designing works for improving tidal rivers are:—

1. To facilitate the entrance of tidal water, and remove all obstructions which tend to diminish the volume of water entering the estuary from the sea.

2. To confine the low-water channel within definite limits of such a form that the stream is gradually enlarged and widened in accordance with its natural proportions."—(Cunningham).

Training walls and dredging are the two methods employed for improving tidal estuaries, and as some remarks on these methods have already been given under "tideless estuaries," they need not be repeated here, but some instances of their use may be quoted:—

Examples of Works on Tidal Estuaries.

(i.). *The Seine.*—Prior to 1848 the estuary of this river was choked with enormous banks of sand and mud, which were constantly shifting and causing trouble to navigation. Vessels of 200 tons, drawing 10′ or less, could only reach Rouen, 74 miles up, by moving with successive flood tides. At low water, they grounded.

From 1848–51, two dykes were built between Villequier and Quillebœuf, one along the right bank, 11 miles long, and the other on the left bank in two lengths of 9,000 and 1,500 yards. The result was very satisfactory. The depth of the channel was increased from 11′ 6″ to 21′ 6″. This successful treatment led to an extension of the dykes during the years 1859—1867. They were at first built of chalk rubble from the cliffs bordering the river, and the material was deposited at random below low-water level, and protected above that by stone pitching, the toe of which was supported at wide intervals

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with rough timber. But after 10 years' experience in maintenance, the authorities decided to strengthen the dykes, and a facing of concrete from 7″ to 15″ thick was put on the inner slope, to cover the rubble from the wearing away by the rise and fall of the tides. A concrete apron about 3 yards wide was also added to the toe of the slope to protect it from the scouring action and waves. The apron was prevented from slipping by a row of sheet piling (see *Figs.* 11 and 12).

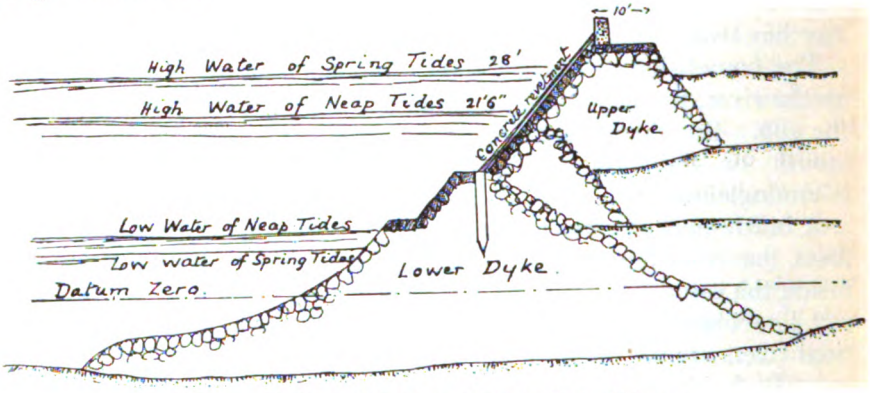

FIG. 11.—*Section of Southern Dyke in Outer Estuary.*

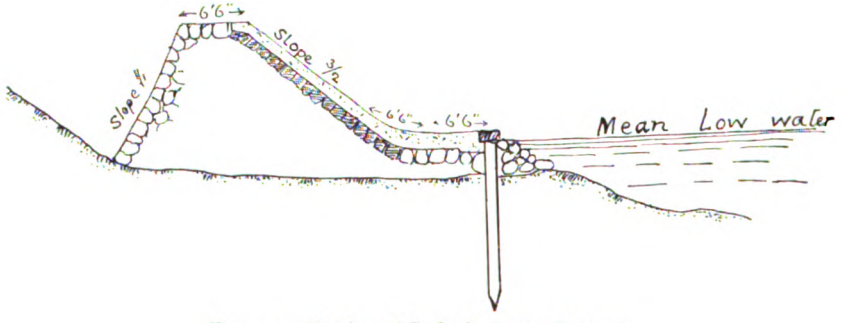

FIG. 12.—*Section of Dyke in Inner Estuary.*

Although these works were eminently successful in deepening the channel, the results still proved to be behind the growing requirements of navigation up to Rouen, and in 1890–96, the dykes were still further extended towards the sea.

But these improvements in the Seine estuary resulted in seriously obstructing the entrance to Havre Harbour, and eventually, in 1895, a new approach to the harbour from the English Channel had to be made.

Further works were carried out in the Seine during 1898—1905, and on the north dyke the extension was carried 7,150 yards, and on the south dyke, 5,200 yards, towards the sea. The distance apart of the dykes at their seaward ends is 1 mile.

There are proposals for more extensions in the near future.

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(ii.). *The Mersey.*—The estuary of this river is of the peculiar bottle-shaped type. Halfway between Runcorn and Birkenhead, the estuary is over 3 miles wide; at Seacombe its breadth is scarcely 1,000 yards. It covers an area of 22,500 acres, but four-fifths of this is one large sandbank which stands above low water of spring tides. The bed of the river is ever varying and is said to change its position every week. It has been known to change entirely from the Lancashire to the Cheshire side within a year.

The river discharges into the Irish Sea by three channels—the Rock Channel, turning sharply to the west past New Brighton; the Crosby Channel, which is the main one, keeping the general north-westerly direction of the river until it approaches Formby Point, where it turns sharply westward to the sea, and becomes Queen's Channel; and thirdly the Formby Channel which keeps on in the north-westerly direction.

The central, or Crosby Channel, is the one used for ocean-going traffic; and in 1890 there was only 12′ at low water of spring tides over the bar. This bar is constantly altering in position, height and extent; and during the past 40 years its crest has advanced a mile further into the sea.

Training works in this case would be very much hampered by the ever-varying conditions, and the channel has been maintained entirely by dredging. The Mersey Dock and Harbour Board have very powerful dredgers at work, including the new *Leviathan*, and have so far been able to cope with the demands of the immense shipping entering the Mersey. Since 1890, 38,000,000 tons of sand have been dredged from the bar, and there is now a minimum depth of 28′ at low water of spring tides.

The sharp bend at Taylor's Bank is constantly becoming sharper, and it is proposed to revet the bank on the northern side with stone for a length of 2½ miles. The stone is to be allowed to find its own slope, and afterwards to be consolidated (*Fig.* 13).

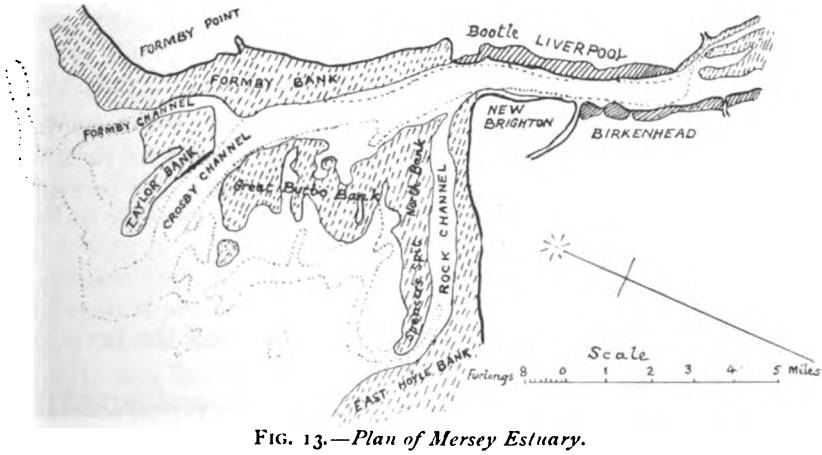

FIG. 13.—*Plan of Mersey Estuary.*

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(iii.). *The Thames* is one of the few important rivers that is practically unobstructed by a bar, but its course is not ideal for the huge amount of traffic passing along it. The bends are too sharp and frequent for the river to be perfect. There are also patches of shoal water between London and the Nore which add to the risks of navigation. Between the Nore and Gravesend there are the Leigh Middle shoals, extending for a distance of 7 miles from Shoeburyness to Canvey Point, and having only 24′ of water at low water. Dredging is going on under the Thames Conservancy (or under the new Port of London Authority) for the improvement of the channel to a minimum depth of 30′ and a width of 1,000′. Outside the Nore there are several channels, all of which are maintained at an average depth of 40′ to 60′ without dredging.—(Cunningham).

TIDAL MODELS.

With a view to the close observation of the effect of various currents during any state of the tide, and of the motion of sand under water, models have been made which faithfully reproduce the natural conditions in a river. An estuary can be modelled with great accuracy, and the tidal flow produced by a "tide generator," which tilts up the water and lets it run back at periods proportional to the periods of the natural tides. The floor of the estuary is made of sand.

"The discrepancy between the vertical and horizontal scales does not materially affect the disposition of the currents or their effect on the movement of the sand."—(Wheeler, p. 327).

The "tide generator" is worked by a water motor, or by electricity, and the period of its "tides" is calculated from the following formula :—

$$X = \frac{\sqrt{H} \times P}{L}.$$

Where X is the period required.

H „ vertical scale of the tank (natural).
L „ horizontal scale of the tank (natural).
P „ natural period of the tides.—(Wheeler, p. 328).

As an example, if P=12 hours 25 minutes=44,100 seconds (a usual tidal period) and the vertical scale of the model be 12′ to the inch, or 144 to 1, and the horizontal scale 4″ to 1 mile, or 1 to 15,840, then the tidal period for the model will be

$$\frac{\sqrt{144} \times 44{,}100}{15{,}840} \text{ or } 33{\cdot}4 \text{ seconds.}$$

The model is made in a tank of suitable size, and the same tank will answer for a number of different estuaries.

Most interesting results are obtained from these models, and they are invaluable to the river engineer.

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(B). WORKS FOR CHECKING FLOODS, ETC.

These principally comprise dams, weirs, and locks—necessarily above the tidal portion of rivers.

In districts suffering from prolonged droughts, the most economical use of whatever rivers are available becomes the chief care of the State.

In those unfortunate districts, when the inhabitants are not suffering from drought, they are generally suffering from floods, and it is necessary to provide works for the conservation of a sufficient quantity of water to cover the period of drought while ensuring that the excess of water in the rainy season shall be quickly disposed of.

There is no space here for a description of the many flood and irrigation works that are in operation throughout numerous countries, but brief notes on some of the most important kinds of weirs are added.

(i.). The *Assouân* Dam is the most important "barrage" constructed in recent years. It is designed to impound 1,000,000,000 cubic metres of water for the development of Lower Egypt. It is part of the scheme for obtaining an annual supply of 6,000,000,000 cubic metres for the proper development of the country, and preparations are being made now to increase the height of the dam by some 29′, and the storage capacity to twice its present amount.

The dam stands 130′ above the bed, and the final head of water will be 85′. There are 140 under sluices each 22′ 6″ × 6′ 6″, and 40 upper sluices, 11′ 6″ × 6′ 6″, capable of discharging the muddy flood waters, which can pass without parting with their silt, while the surplus of the comparatively clear winter supply will be stored for use in summer. If the flood waters were obstructed, the reservoir would soon be choked up with mud and silt, and obliterated. The discharge is regulated by well-balanced roller gates.

(See *Corps Papers*, Vol. XXVI. 1900. Article by W. Willcocks, Esq., C.M.G., also *Proceedings of the International Engineering Congress, Glasgow*, 1901: report of Section II. Waterways and Maritime Works).

(ii.). *The Assiout Weir.*—This is some 300 miles below the Assouân Dam, on the Nile. It was built in conjunction with the dam in order to provide means for utilizing the discharge, and diverting the water into the canals and branches below it. It is rather a regulating bridge than a weir. It has a masonry platform 10′ thick, 90′ wide, and laid flush with the river bed. This floor has iron sheet piling 16′ deep as up and downstream curtains.

The weir is capable of sustaining 10′ head of water in flood, and 14′ head in summer. It has 111 openings 16′ wide and 29′ high; and the piers are 6½′ wide.

(iii.). *Weirs Generally* may be classified as follows:—

(*a*). Overfall weirs.

(*b*). Draw-door or sluice-gate weirs.

(*c*). Movable weirs.

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(*a*). *Overfall Weirs* are barriers placed across a river to hold up the water until it has risen above their top or "sill." Not a suitable kind for the rapid discharge of flood waters, they diminish very much the original waterway. To obviate this drawback, they are sometimes placed obliquely across the stream, and the section of waterway over them made equal to the section of river channel above. But these oblique weirs tend to "divert the main current and consequently the deepest channel towards the bank against which the upstream end of weir rests."—(Vernon-Harcourt).

The weir may be made in two straight lines, meeting in the centre of the stream and the angle pointing upstream. Or the weir may be curved, with the convex side upstream.

Anicuts, or weirs on Indian rivers, very commonly employed, are overfall weirs.

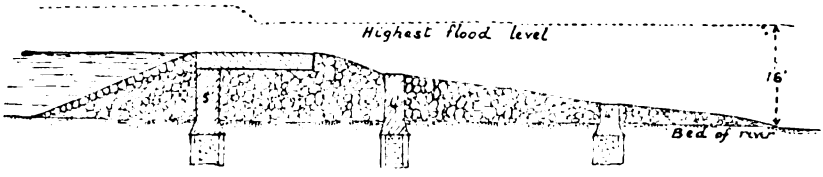

FIG. 14.—*Section of Anicut.*

(*b*). *Draw-Door Weirs.*—These have a series of panels or doors sliding in vertical grooves formed in a row of piles or piers. In order to reduce the power required to raise heavy draw-doors, iron rollers are hung in a recess at the side of the door.

Teddington weir is a good example.

(*c*). *Movable Weirs.*—Capable of being lowered on to the bed of the river, or otherwise removed, so as to prevent obstruction to the discharge in flood time.

Four different types—

(i.). Movable frame or "needle" weir.
(ii.). Movable shutter.
(iii.). Drum weir.
(iv.). Segmental gate weir.

(i.). Movable frames serve to support the "needles" or stanches when upright; and can be lowered to bed of river in flood. The frames are of light construction, generally wrought iron, placed end on to the current at regular intervals, connected together, when vertical, by movable horizontal iron bars, and hinged to the apron of the weir.

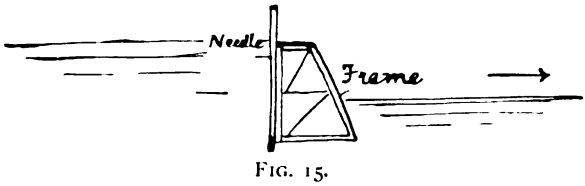

FIG. 15.

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The needles rest against a sill in the apron, and against a horizontal bar between the frames at the top. The frames can be lowered by chains.

This kind of weir is a simple and comparatively cheap one.

(ii.). *Movable Shutter.*—Simplest form is a gate or shutter hinged horizontally at bottom supported by a prop which may be lowered and raised hydraulically.

(iii.). *Drum Weir* consists of an upper and lower iron paddle revolving on horizontal axis through $\frac{1}{4}$ circle. Upper paddle forms the weir which it closes when upright, and under one (slightly larger than upper) revolves in closed recess below sill of weir.

The weir is closed by raising sluice gate in abutment at end of weir, which lets the water from the upper pool press on the upper face of the under paddle and this, by overcoming pressure of water on the upper paddle, swings it into vertical position and closes weir. The weir is opened by lowering the sluice gate; this removes the pressure on the upper face of lower paddle, and the current pushes down the upper paddle.

Ex.—Weir on Marne at Joinville. 42 paddles $3' 7'' \times 4' 8''$ can be completely opened or closed in three or four minutes by one man.

Drum weirs are only suitable for overfalls: for they require too much depth of foundations below sill.

(iv.). *Segmental Gate Weir.*—Series of segmental gates between masonry piers. Gates are cellular, and of cylindrical segment form. They are made of wrought iron or steel and revolve on horizontal axis to which they are attached by six radiating rods at each side. The axis turns on pivots fixed in each pier. The gates are counterbalanced by weights in a hollow in the piers, and are easily turned through a small arc by chains worked from the piers.

Comparison of Various Forms.

Overfall Weirs are economical; require little maintenance and no expense in working.

Draw-Door Weirs.—Cheaper than movable weirs, and easier to manage; afford freer flow than solid weirs; admit regulation of the discharge, and consequently, the levels of a river.

Drum Weirs.—Theoretically almost perfect; practically, unsuitable for navigable rivers.

Segmental Gate Weirs.—Expensive and complicated. Not much used, but strong, and can be made of large dimensions.

Inland river traffic in England is too small to justify heavy expenditure on improvements, and railways have cut out river traffic except for a very few items, such as ballast, stone, in some cases coal, hay, etc.

On the Continent, however, the improvement of rivers has been, and is, much studied.

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APPENDIX.

LIST OF SOME BOOKS, ARTICLES, ETC., ON RIVER WORKS.

PROFESSIONAL PAPERS OF THE CORPS OF ROYAL ENGINEERS.

"Barrages and Collateral Works on the Nile." By W. Willcocks, Esq., C.M.G. Paper 7. Vol. XXVI. 1900.

Includes an account of Assouân Dam and Assiout Weir.

"On the Method employed in keeping the Nuddea Rivers open to Navigation during the Season of Low Water." By Major R. H. Brown, R.E. Paper 4. Vol. XV. 1889.

Gives an account of training jetties or spurs used on some Indian rivers to prevent silting up of navigable channels. A useful paper for the principles of river training with scanty materials.

"On the Mouths of the Danube and the Improvement of the Mouths of Rivers in non-tidal Seas." By Major Stokes, R.E. Paper 5. Vol. XIII. New Series. 1864.

Contains some account of the Danube mouths at time when the improvement scheme had just been started.

ARTICLE IN "ENGINEERING."

"Estuary Channels and their Treatment." By Brysson Cunningham. *Engineering*. Oct. 30, Nov. 20, Dec. 4, and Dec. 18. 1908.

BOOKS.

Tidal Rivers. Their Hydraulics, Improvement and Navigation. By W. H. Wheeler, M.INST.C.E. Longman's Civil Engineering Series. 1893.

An exhaustive work containing many examples of river improvement; also chapters on Tides, and Tidal Models. Mr. Wheeler has much experience of the rivers in the Fen Country.

Rivers and Canals. A Treatise relating to the Control and Improvement of Rivers, and the Design, Construction and Development of Canals. Vol. I. Text; Vol. II. Plates. By L. F. Vernon-Harcourt. Oxford: Clarendon Press. 1882. 21s.

Contains useful information on different forms of training works, with several examples and some excellent plates.

Proceedings of the Waterways and Maritime Works Section of the International Engineering Congress, Glasgow, 1901. Published by Wm. Clowes & Sons, 32, Cockspur Street, S.W. Price 6s. 6d.

Contains interesting papers on :—

"Irrigation in the Nile Valley and its Future." By W. Willcocks, Esq., C.M.G.

"The Improvements of the Lower Mississipi River." By J. A. Ockerson, Esq.

"Recent Improvements effected in the Navigable Condition of the Sulina Branch and Outlet of the Danube." By C. H. L. Kühl.

"The River Clyde and Harbour of Glasgow." By W. M. Alston, Engineer-in-Chief to Clyde Navigation Trustees.

"Improvement Works on the Clyde Estuary." By D. and C. Stevenson.

"Works for the Improvement of the Bilbao River and Making an Outer Harbour." By Señor don Avaristo de Charruca.

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*MAJOR-GENERAL SIR WILLIAM REID, R.E., G.C.M.G., K.C.B., F.R.S.**

(Continued).

By Col. Robt. H. Vetch, c.b., late R.E.

Shortly after the Battle of Vittoria Napoleon sent Marshal Soult back to the south to replace Joseph Buonaparte as his lieutenant. In a marvellously short space of time he reorganized the beaten French forces as the "Army of Spain." While Reid was at the first Siege of St. Sebastian and afterwards laid up with his wound, Soult made a determined effort to relieve Pampluna. For nine days he fought an obstinate and bloody battle with the allied army among the mountains of the Lower Pyrenees, but was eventually forced back by Wellington early in August. Not discouraged he again crossed the Bidassoa at the end of the month to endeavour to relieve St. Sebastian, and on the 31st, the very day in which the town was successfully stormed, he was once more defeated by the allied army and forced to retrace his steps to his position behind the Bidassoa River.

On recovering from his wound Reid joined the Light Division again as senior officer of Royal Engineers under Major-General Count Charles Alten. So long as Pampluna held out it was impossible for Wellington to act on the offensive on a large scale, but he decided to improve the position he held by crossing the Bidassoa River into France. His project was a bold one. He proposed to seize the Great Rhune Mountain and its dependencies on the French side of the river, and to drive Soult's forces from the strong position they held from the mountain to the sea. By the possession of the Rhune Mountain he would menace the centre of the French line and at the same time obtain possession of the port of Fuenterabia. Since the fall of San Sebastian nearly a month had gone by without any hostile movement on the part of either army. The weather was cold and wet, and while the officers were able to amuse themselves the men were having a bad time and were discontented.

* Articles on Sir Wm. Reid appeared in the April and May *Journals*, under the title of "The Fyers Family." As however they deal entirely with the life of Sir W. Reid—whose career has never yet been fully chronicled in the Corps History—in future they will appear under the above title.

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The dispositions for the attack were made on the 6th October, and at 3 a.m. on the 7th the troops were under arms. Every precaution was taken to prevent discovery by the enemy. The troops moved in silence. The night had been dark and stormy; a thunderstorm which rolled over to the French side of the river in the early morning served to prevent the noise of the artillery and of the pontoon train being heard by the enemy, and the troops succeeded in gaining the different fords of the river without being discovered.

The Light Division, supported by Longa's Spanish Corps, crossed the river to attack the enemy holding the Bayonette Mountain of La Rhune, and the position of Vera.

The French were as unprepared here as on the other flank. The attack on the Puerto de Vera was peculiarly brilliant. The approach was narrow and completely commanded by several strong redoubts on the acclivities and summits of the steep mountains above the village of Vera. But nothing deterred the advance of the Light Division, which crossed the river at the Salinas ford; one brigade attacked the right of the position and drove the enemy from their entrenchments; and another brigade attacked the pass of Vera and carried it. A French brigade was cut off and a mountain battery and 400 men were captured. Having possessed themselves of the Bayonette and Commissari Valleys and the Puerto de Vera, their Spanish supports assailed the Rhune Mountain at 3 o'clock in the afternoon, but the French held on to the post on the summit of the mountain until the morning, when it was surrendered. The allied army was now encamped on French soil, occupying a series of commanding positions ready at any moment to continue its advance.

That moment came when Pampluna capitulated on the 31st October. But delayed by bad weather it was the 10th November before Wellington attacked Soult's strongly fortified position covering St. Jean de Luz and extending from the sea across the Nivelle to the heights behind Ainhoe. Of this position Wellington himself said he had never seen anything more formidable. Again the advance was made at night and in silence. By early dawn the whole force was in position at the verge of the line of out-piquets, the troops lying extended on the ground awaiting the order to move. A false attack was to be made on the French right wing while an endeavour was made to penetrate the centre of the enemy and separate the wings. The left column of the centre of the allied army consisted of Alten's Division, supported by Longa's Spanish Corps. This column advancing with the greatest impetuosity forced the entrenchments on Petite La Rhune and, having driven the enemy from their redoubts, formed up on the top of the hill. Then, continuing their advance with the other column against the heights in rear of Sarre under a heavy fire, the enemy fled in disorder towards the bridge over the Nivelle. While the Light Division was attacking a redoubt, the other column

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of the centre intercepted the retreat of the garrison, and an entire French battalion 600 strong was captured.

The French General Clausel seeing the retreat of the French left wing tried to retrieve the day, but Alten, having descended the Rhune by a ravine on Ascain, drove the enemy through the ravine and beyond the bridge, so that the rout became general; the works and position in front of St. Jean de Luz were abandoned, and Soult fell back on a prepared position between the village of Anglet and his entrenched camp in front of Bayonne. The result of these operations was the capture by the allied army of 50 guns, 1,500 prisoners and a considerable quantity of stores and ammunition.

For nearly a month the allied army settled down in cantonments on the hills it had conquered. The country people brought in supplies freely, and the officers added to these by shooting cock and snipe, hares and rabbits. Wellington's foxhounds were unkennelled, he himself took the field regularly twice a week, and a crowded field attended the meets.

Reid, with the Light Division, occupied the church and village of Arcangues, situated upon rising ground and of considerable natural strength, to which, by his advice, were added fieldworks to still further strengthen it. This precaution proved of inestimable value.

The enemy in the meanwhile guarded the right bank of the Nive and communicated with a division under General Paris at St. Jean Pied de Port. Thus the allies occupied only the confined space between the sea and the Nive, and were cut off from the productive country beyond the river which afforded large supplies to the enemy. Wellington decided therefore to cross the Nive and drive back the French outposts from the strong ground between the Nive and the Adour. The 9th December was fixed for the advance. The evening before, the pontoon train passed through Arauntz as quietly as possible, and the troops were under arms some hours before daylight on the 9th. The right wing of the allied army, under Hill and Beresford, crossed the Nive at Cambo and Usteritz and dislodged the enemy, while Hope and Alten, on the left, advanced and drove the French into their entrenched camp before Bayonne. When darkness came on the enemy withdrew within the lines of Bayonne, and Hope and Alten returned to their former cantonments. On the 10th Soult seeing that the two wings of the allied army were separated by the river directed a powerful attack on the left of the allies covering St. Jean de Luz. The fighting was very severe. A French column drove the outposts of the Light Division within the village of Arcangues, which as we have seen, thanks to Reid, had been strongly entrenched. Repeated efforts were made to drive the Light Division from their defences, but these efforts were always repulsed with great loss. At the close of the day the French retained possession of the plateau of Bussussary in the immediate front of Arcangues.

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During the night Soult withdrew the bulk of his force from its position in front of Sir John Hope, intending to attack the Light Division in overwhelming numbers. As soon as a thick fog cleared off on the 11th about 10 a.m. the French divisions moved to the attack with loud cries of "En avant, en avant!" but were again repulsed. At the close of the day both armies remained in the same positions they had occupied the previous night. On the 12th Soult altered his plans. Foiled in his attack on the allied left, he withdrew his own right wing through Bayonne with the intention of throwing his whole weight on Wellington's right, commanded by Hill.

On the 13th was fought the Battle of St. Pierre, the last day of the fight on the Nive, which was begun on the 9th. The force under Sir Rowland Hill was about 13,000 men. They were attacked by 30,000 under Soult. The French were completely defeated, and escaped with difficulty within their lines, leaving 5,000 men on the field. Soult then crossed the Adour, D'Erlon's three divisions remaining in front of the camp of Mousseroles. On this last day Reid was not engaged, as the Light Division was still posted on the heights of Arcangues. The extreme severity of the weather now induced Wellington to place his army in cantonments for the remainder of the winter.

I have thought it well to narrate the doings of the army in the field, having special reference to the Light Division to which Reid was attached. Unfortunately there are no records available of the part he took in it as senior officer of the Royal Engineers to the Division. Judging from his activity in the field in the previous June we can well understand that he was no less active in the passage of the Bidassoa, and the Battles of the Nivelle and of the Nive. In fact when we know how well the Light Division had entrenched their position at Arcangues it is not difficult to see in it the directing mind of Reid. Probably there are despatches of Alten's which mention his name but I have not been able to ascertain.

During the winter of 1813—1814 Wellington matured his plans for carrying the war into the interior of France. But first Vauban's fortress of Bayonne must be invested and besieged. The city stands on the left bank of the Adour at the confluence with the Nive about 4 miles above the sea. Wellington boldly proposed to hold Soult in check with his right on the *gaves** of the Pyrenees, while a bridge of boats across the Adour, near its mouth, was constructed, and a force moved across it to besiege the citadel of St. Esprit, on that side of the river, the place itself being blockaded. In this way, if he succeeded in passing the Adour as he proposed, he would interpose

* The torrent streams which flow into these rivers are known by the vernacular name of *gaves*, and are distinguished by the name of the principal town on them: thus the *Gave* d'Oleron, *Gave* de Mauleon, *Gave* de Pau, etc.

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between Soult and Bordeaux and, whether he succeeded or not, he determined to push Soult further into France with his main army.

Reid was one of the Engineer officers detailed for the bridge under the direction of Lieut.-Colonel Elphinstone, the Commanding Royal Engineer. The place selected for the bridge was in the bend of the river, $2\frac{1}{2}$ miles below the permanent wooden bridge between the town and the citadel, and $1\frac{1}{2}$ miles above the sea. In the latter space 200 or 300 transports in attendance on the army would find secure anchorage. The Adour at the point selected was bounded on both banks by high retaining walls, and the breadth of the stream was about 300 yards. There was a rise and fall of tide of 14′, and on the right bank the high tide flooded the country to some extent. The ebb tide ran out at about 7 miles an hour.

Forty-eight decked vessels of from 30 to 50 tons burden, called *chasses-marées*, were hired in the ports of St. Jean de Luz, Passages, and Socoa. They were assembled at Socoa, where the bridging superstructure was collected. Timber was difficult to get and therefore 13″ cables were substituted for wooden balks. The vessels were to be anchored head and stern, at 30′ distance from centre to centre, in a direct line across the river. Five cables were provided to pass over, and be supported on, the deck of each vessel so as to extend from bank to bank. The cables were at 2′ intervals, being kept apart by means of grooves cut in a stout sleeper spiked to the deck of each boat. The ends of the cables were to be fixed on the right bank, each to an 18-pr. iron gun let down over the wall into the marsh beyond, and on the left bank attached to a loaded frame and tackle so that the cables could be stretched taut and regulated for the height of the tide.

The Royal Sappers and Miners, artificers from the Guards, and from the Royal Staff Corps, with large parties from the Navy worked incessantly, under the direction of the officers of Royal Engineers, at Socoa. Orders to begin were issued on the 7th February and by the 19th the preparation was complete. The *chasses-marées* were told off into five divisions; the centre under command of Capt. Slade, R.E., the two right divisions under Lieuts. Savage and West, R.E., and the two left under Lieuts. Robe and Rivers, R.E. Lieut. Reid was charged with securing the ends of the cables to the guns and hoisting them over the wall of the right bank into the marsh; while to Lieut. Melhuish was committed the duty of securing the purchases and hauling the cables on the left bank.

Fortunately it was the conviction of Marshal Soult that Wellington could never cross the Adour anywhere, least of all near its mouth. The river between Bayonne and Toulouse receives several tributaries such as the Gaves of Oleron and Pau, torrential streams descending out of the Pyrenees, very abrupt in their banks and not easy to bridge, and Soult had taken precautions to guard all the passages by troops

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placed in entrenched positions. He entirely disregarded any idea of the river being bridged near its mouth, as it would require pontoons of considerable size and the great and dangerous sandbanks of the estuary, forming a bad bar, presented difficulties which he was led by the local authorities to regard as insurmountable in the presence of the powerful flotilla of French gunboats in the river and the large garrison of Bayonne. Moreover he considered that the most obvious strategic reasons would lead Wellington to threaten him in the direction of Pau. It was, therefore, a surprise to him to find that his adversary not only pressed him strongly with his right, but, crossing the Adour near its mouth, outflanked him with his left.

The right and centre of the allied army, by a series of manœuvres and small affairs between the 14th and 17th, had driven the French behind the Gave d'Oleron, and obliged Marshal Soult to give up his communications with Bayonne. They were now in march for further triumphs in the direction of Orthes. The left wing comprising the 1st and 5th Divisions under Lieut.-General Sir John Hope was left to deal with Bayonne.

On the evening of the 22nd February the *chasses-marées* put to sea from Socoa, escorted by Admiral Penrose with the *Porcupine*, frigate, the *Lyra*, brig, and five gunboats. The command of the flotilla and the nautical arrangements of entering the Adour and bringing the *chasses-marées* to their anchorage were under Capt. O'Reilly, R.N. To ensure the unmolested entry of the flotilla into the river, it was arranged to gain possession of the right bank the same night by means of troops to be ferried over in jolly boats and on pontoon rafts.

Part of the 1st Division moved at 1 a.m. on the 23rd February from their cantonments to establish a post on the further bank of the Adour before daylight. The troops with a battery of four 18-pr. guns, the rocket batteries, some pontoons and jolly boats marched along the high road to Bayonne till near the village of Anglet; they then turned to their left into a cross-country way and, with some difficulty, reached the left bank of the Adour near its mouth before daybreak. It was found that the pontoon train from Bidart had not arrived and the troops were halted behind the sandhills to wait for it. During this halt the French were driven out of Anglet and of the great pine wood which stretches along the left of the river, and confined within their entrenched camp. This action left free space for the operation of throwing over the bridge, to protect which the 18-prs. and rocket batteries were put in position on the sandhills opposite Boucaut and, on opening fire, obliged the French gunboats to retire from the anchorage to a position higher up the river.

As slack water approached and there was no sign of the pontoons, at 11 a.m. on the 23rd, Hope decided to commence the passage.

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Fifty men were soon rowed over in the jolly boats, and a hawser was stretched across the river and made fast on the two banks. In the course of the day about 800 men had been passed over. These men were attacked by a superior force from Bayonne, but were so well placed and so well supported by the guns and rockets on the left bank of the river that their assailants retired again to Bayonne. The pontoons having arrived from Bidart, pontoon rafts were substituted for the jolly boats, and by the evening of the 24th the whole of the 1st Division was on the right bank.

When the flotilla put to sea from Socoa on the evening of the 22nd the wind was fresh but contrary, on the 23rd it was light and variable, and on the afternoon of the 24th it set direct on land, driving a heavy sea before it. Led by the brig, *Lyra*, the flotilla ran for the mouth of the river. The brig was engulfed in the surge and all on board her, including the chief pilot, were drowned. The gunboat, *Woodlark*, Lieut. Cheyne, then struck the right course. The high surf on the bar and the uncertainty of hitting off a shifting channel dismayed the native crews of the *chasses-marées*, but on board of each was either an officer of R.E. or one or two sappers, who compelled them to follow the men-of-war's boats. Thirty-four entered the river without accident. Of the other 14, one grounded on the bar, one was driven ashore and 12 returned to St. Jean de Luz. The *chasses-marées* on reaching the spot for the bridge were anchored head and stern by the Navy, and the Sappers working through the night completed the bridge by noon on the 25th February. Then the rest of the infantry with the cavalry, artillery, and baggage, etc., passed over.

Admiral Penrose in his despatch of this date says: "That so many *chasses-marées* ventured the experiment I attribute to there having been one or more sappers placed in each of them, and a captain and eight lieutenants of Engineers commanding them in divisions. The zeal and science of these officers triumphed over the difficulties of the navigation, and I trust that none of their valuable lives have fallen a sacrifice to their spirited exertions." The bridge from this time to the end of the war formed uninterruptedly the principal communication of the army before Bayonne with France. All historians agree with Napier in considering the passage of the Adour "a stupendous undertaking which must always rank amongst the prodigies of war."

I cannot conclude this account of the celebrated passage of the Adour without a reference to the gallant Capt. Pitts, whom I have several times quoted, and who was always a great friend of Reid. While Reid was busy at Socoa his friend was with the army on the Gaves. On the very day, the 23rd February, when the first British force crossed the Adour in boats and on pontoons, Pitts was killed

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before Hastingues, on the Gave d'Oleron, while accompanying his General in a reconnaissance of that place.*

On the completion of the bridge of boats over the Adour River, Lieut. Reid was ordered to rejoin the Light Division. He had missed the Battle of Orthez, which Wellington won on the 27th February, defeating Marshal Soult, who retreated on Toulouse followed by the allied army. There is no document to show precisely at what date Reid joined Wellington's Army again, but as he was present at the Battle of Toulouse, and was not required at Bayonne after the end of February, it is most probable that it was about the middle of March. For when Wellington despatched Marshal Beresford with 12,000 men to Bordeaux on the 8th March, he had ordered the Spanish Reserve at Irun under General Freyre and every other disposable body to join his army without delay to replace the force sent to Bordeaux. On the 16th and 17th of March Wellington halted to allow the Spanish Reserve, Ponsonby's dragoons, and other details to come up, and we may assume that Reid joined the Light Division at that date. Considering that a smaller force than Beresford had taken to Bordeaux would suffice to overawe the city, Wellington recalled Beresford with the 4th Division and Vivian's cavalry, leaving Lord Dalhousie with the 7th Division and three squadrons of cavalry to keep an eye on Bordeaux.

When Wellington moved on Vic Bigorre Reid was engaged in the turning movement of the Light Division on the 19th March and at the combat of Tarbes on the 20th, when Alten attacked Clausel's centre on the heights of Orliex. The struggle there was wonderfully fierce and violent, the men fighting muzzle to muzzle, but at last the French gave way. Hill's Division drove them out of Tarbes on the right while Clinton's artillery thundered at them on the left until dark. During the night Soult retreated rapidly towards Toulouse, which he reached on the 24th, having destroyed all the bridges behind him.

The wet weather and swollen streams made it necessary to repair the broken bridges and make temporary ones, as the fords were not available. Reid and the other Engineer officers worked hard, but the army was delayed and did not reach the Garonne until the 27th. It halted on that day in front of Toulouse and found the French Army entrenched around the city to the best advantage.

Toulouse is a fortified town whose position on the right bank of the Garonne is naturally a very strong one. It stands to the east of

* There is a memorial tablet over the entrance to the nave of the English church at Biarritz, on which are inscribed the names of three officers of the Corps of Royal Engineers, who were killed after the allied army entered France. The inscription is as follows:—"Lieut. Geo. Power, Nivelle, Nov. 10 (1813), Capt. T. J. H. Pitts, Gave d'Oleron, Feb. 23 (1814), Capt. Edwd. Parker, Orthez, Feb. 27 (1814)."

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the elbow of a sharp bend in the river which here flows from south to north. Opposite the town, on the concave side of the bend to the west, is the suburb of St. Cyprian covering a fine bridge which connects it with the town. In front of this suburb was an ancient brick wall, 3′ thick, flanked by two massive towers. Outside this wall Soult had thrown up flanked entrenchments running across the loop from the river above the town to the river below. It was on this side of Toulouse that the allied army arrived.

The east and north sides of Toulouse were covered by the canal of Lanquedoc as it passes to join the Garonne below the town. The suburbs of St. Etienne and Guillermerie furnished outworks on the east, as they were entrenched and connected with the fortified hills of Sacarin and Cambon, which covered them and flanked the approaches to the canal above and below. Half a mile beyond these hills was the ridge of Mount Rave with a fortified position on the top. The ridge is parallel to the canal, and lies between it and the river Ers. On the south is the suburb of St. Michael, and beyond it a hill called the Pech David.

An attack on the suburb of St. Cyprian in front of the allied army could only have been successful by an enormous sacrifice of men. Wellington at first crossed the Garonne above the town, as the south side was by far the weakest, but finding the country unsuitable for the movement of artillery, he withdrew to the left bank again. On the 3rd April he threw a bridge across the river on the north side, some 15 miles below the town. Marshal Beresford with three infantry divisions and three brigades of cavalry crossed, but the rise of the river damaged the bridge and communication ceased till the 8th. Beresford was isolated, but Soult lost his opportunity making no attempt to attack him; all this time he was busy strengthening his field of battle about Toulouse. Although he heard on the 7th that the allies had entered Paris, the news only strengthened his determination to fight on such favourable ground as he then occupied.

The waters of the river having subsided the bridge was again constructed on the 8th April, when Freyre's Spaniards and the Portuguese artillery crossed over; but the situation was found inconvenient and the bridge was moved on the 9th to a place 5 miles higher up the stream and nearer the town. Here the Light Division crossed on the 10th and took up a position on the north side of Toulouse, across the road to Montauban.

Soult's position covered three sides of Toulouse. His left defended St. Cyprian on the west; his centre the canal on the north; while his right held Mount Rave on the east. For the attack Sir Rowland Hill was in front of St. Cyprian, the 3rd and Light Divisions, under Picton and Alten respectively, on the north of the town, and Beresford on the east of Mount Rave. The plan of battle was that Hill should confine the enemy within his entrenchments on the west; Picton and Alten

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keep him in check on the north, threaten the *têtes de pont* in front of the canal bridges, and also attempt that part of the town near the river; while Beresford on the left was to cross the bridge over the river Ers at Croix d'Orade, which had been carried by the 18th Hussars, and drive the enemy from the village of Monblanc, then move by the left bank of the Ers till he gained the enemy's right, and attack his right flank; simultaneously Freyre's Spaniards were to attack the French left flank and effect a junction with Beresford.

The position of Mount Rave was a very formidable one. Every point of vantage was crowned with redoubts; all the bridges across the canal and the Ers stream were mined and covered by *têtes de pont;* and the banks of the Ers were inundated from the Croix d'Orade to the Porte les Bordes.

Beresford carried the village of Monblanc and proceeded along the Ers, flanked by skirmishers, until he gained the point of attack, when he advanced in line against the enemy's right. At the same time Freyre moved forward and drove a brigade of the enemy before him. On nearing the entrenchment, however, the Spaniards were received with so heavy a fire of grape that they were driven back with great slaughter. To cover the retreat of the Spaniards the Light Division was ordered to move to its left and Freyre rallied his men, and drove back the enemy. In the meantime Beresford was more successful. The principal redoubt was captured, and two divisions established themselves on the top of the hill. Beresford had then to wait until his artillery came up.

The Light Division had made a false attack on the *tête de pont* in their front with a trifling loss, while the 3rd Division had been repulsed. Across the Garonne Sir R. Hill drove the enemy within their works in front of St. Cyprian and alarmed them by threatening a powerful attack in that quarter.

Beresford's artillery having arrived, he continued his movement along the ridge. The division of the French General Taupin was completely routed and Taupin himself killed. Pack's Brigade carried two redoubts and the fortified houses in the centre of the ridge. A great effort was unsuccessfully made by the French to regain these works and their loss was great. Then Soult fell back to a new position in front of the canal on the east side of the town, but was forced to retire across it.

Hill, on the west, had compelled the enemy to abandon the whole of the advanced line of entrenchments, and to retire within the walls of St. Cyprian. Then Soult withdrew his army into the town and prepared to defend it. Wellington invested the place, and Soult, knowing it to be untenable, left it with his army on the night of the 11th, and hastened by forced marches along the road to the south as far as Carcassonne, pursued by Hill's troops.

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Toulouse surrendered and Wellington entered it at noon on the 12th. The same afternoon news was brought from Paris by a French and an English officer of the abdication of Napoleon. When the French officer reached Soult the following day the Duke of Dalmatia demurred to his authority, and proposed a suspension of hostilities until he had received authentic instructions from the Emperor. Wellington refused to accede to the proposal and marched against him. On the 17th the outposts were on the point of engaging when Soult notified his adhesion to the new state of affairs in France. A convention was agreed upon and the war was at an end. It is sad to think how many lives were unnecessarily lost on both sides at Toulouse and elsewhere, on account of the delays in transmitting the news that peace had been declared.

Reid returned to England in June, 1814. He had left it a subaltern early in 1810, he returned still a lieutenant in 1814. These four years had been years of constant fighting, in which he had as constantly distinguished himself, and the officers under whom he had served had one and all recommended him for promotion. His case was so striking that nearly half a century later when discussions arose in the House of Commons upon the system of purchase in the Army, the late Lieut.-General Sir Frederic Smith, Colonel Commandant of Royal Engineers and Member for Chatham, referring to it, told the House how Sir William Reid, who had then quite recently died, was, as a young lieutenant of the Royal Engineers, the senior of his corps with the Light Division in the Peninsular War, while under him was a young lieutenant of the Line, acting as Assistant Engineer. Reid was so satisfied with his subordinate's conduct that he strongly recommended him for promotion to the rank of Captain. His recommendation was approved and his assistant was promoted. Before the war was over the Assistant Engineer had become a Lieut.-Colonel, while Reid, who had been engaged in 30 affairs with the enemy, including seven sieges and five general actions, who had been three times wounded, and had three times had his horse shot under him, returned to England, as he had left it, a simple subaltern.

After many years had passed he received in recognition of his Peninsular services a silver medal with eight clasps.

Reid had not been a month at home when he was placed under orders to go on an expedition. This was in July, 1814, but for some reason or other his services were not actually required until several months later. He had well earned a rest and no doubt he spent some part of his leave in visiting his parents in Scotland, and perhaps also his uncle in Dublin.

During the preceding two years this country had been at war under many difficulties with the United States of America, but the termination of the European War rendered the whole military power of England available to prosecute the war with that country. A

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large force of Peninsular veterans under Major-General Ross, and a naval force under Rear-Admiral Cockburn had sailed from Bordeaux in June, 1814, for the Chesapeake. The Battle of Bladensburg was fought and won on the 24th August, and the capture and destruction of Washington followed. Then in September came the unsuccessful attempt on Baltimore, when General Ross was killed. The troops were withdrawn on board ship and proceeded down the river to join the rest of the fleet. In October they sailed for Negril Bay in Jamaica under sealed orders. On the 24th November reinforcements arrived with Vice-Admiral Sir A. Cochrane and Major-General Keane who took command of the troops, and two days, later the expedition sailed for New Orleans. On the 10th December the fleet anchored off the Chandeleur Islands near the entrance of Lake Borgne. After the enemy's gunboats had been all captured or destroyed the troops were landed by boats upon a small desert island, called Pine Island, some 30 miles up the lake. The disembarkation was completed on the 21st December. On the 22nd General Keane sent an advance force of 1,600 men under Colonel Thornton to land at Isle aux Rois, a marshy spot at the mouth of the Pearl River. A sharp skirmish took place on the 23rd, in which the Americans were defeated. The whole of Keane's force arrived by the 24th.

In the meantime, when the death of General Ross became known in England Sir Edward Pakenham was appointed to succeed him, with Major-General Gibbs as his second in command. Reinforcements, as we have seen, under Major-General Keane had been sent to Jamaica for the expedition; and a further reinforcement was despatched from Plymouth, consisting of 2,000 men under Major-General Lambert, in November, 1814. A week later Sir Edward Pakenham sailed from England in the *Statira* frigate, with Colonel Burgoyne as his Commanding Royal Engineer, and made a very rapid passage to Jamaica; I have been unable to ascertain whether Reid sailed with Lambert, or with Pakenham. I am inclined to think with the latter, because his record of service shows him "at sea and in America from December, 1814, to May, 1815."

(*To be continued*).

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The late Major C. O. C. Bowen, D.S.O., R.E.

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MEMOIR.

MAJOR CHARLES OTWAY COLE BOWEN, D.S.O., R.E.

By E.N.M.

THE cablegram announcing the death of Major Bowen on the 18th of March at King's Hill, Orange River Colony, will have given profound grief to his many friends in the Corps.

He came of an Irish family, which had long owned and lived at Bowen's Court, Mallow, County Cork. Here he was brought up in the midst of his beloved Duhallow country and, long before he grew up, was an all-round sportsman ; in such surroundings too the seeds of his future illness were probably laid.

In September, 1885, Bowen joined the R.M.A., Woolwich. During his second term there he contracted inflammation of the lungs, had to drop into the term below and passed out in February, 1888. After two years at the S.M.E. he joined the 12th (Field) Company at the Curragh in April, 1890, and soon afterwards went with his company to Aldershot, where he remained till 1893. In that year he was first sent abroad as a subaltern of the 36th (Fortress) Company in Bermuda.

During his time at that station a bit of bad luck befell him. By some chance he did not get the usual tour of duty at Halifax and, as he never in his life complained of his lot or sought officially to improve it, he served four years in Bermuda, the climate of which is not favourable to real lung trouble, such as by this time Bowen well knew he had. The result was that, though he served out his time, he had to be invalided home in 1897, when he was again sent to Aldershot.

He joined the 1st Field Troop (then the Mounted Detachment) as subaltern, and, at the beginning of 1899, took command of it. These were apparently years of progress in health, but he was never quite so well after his two months' leave at his Irish home. He had also become quite deaf in one ear, though he scarcely ever let his friends know how much real trouble he had.

In October, 1899, the South African War broke out. As the war strength of his troop included a major, he met with what must be a trial to the best of soldiers, the loss of the command of his unit just as it was ordered on service, and after he had been the helmsman through the very critical early life of the mounted Engineers. No man living could have risen to the occasion and done his duty more

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manfully. He loyally accepted the new conditions and during the campaign, until he regained his old command, he set officers and men a great example of gallant service and willing co-operation.

In the South African War Bowen served with French in front of Colesberg, and subsequently under the same general saw Kimberley relieved, Cronje taken at Paardeberg and the surrender of Bloemfontein. With the Cavalry Division he marched on Pretoria and was present at the Battle of Diamond Hill.

At the beginning of 1901 he resumed the command of what was now the first of four Field Troops. After the usual wanderings over the Transvaal, a depôt for mounted Sappers was formed at Middleburg, Transvaal, where Bowen remained while his subalterns with their sections accompanied the various columns.

At the conclusion of peace Bowen brought his troop home to England. His own well-deserved rewards included two mentions in despatches, the Queen's S.A. Medal with clasps for Paardeberg, Driefontein, Johannesberg, Belfast, Diamond Hill and the Relief of Kimberley ; the King's S.A. Medal with two clasps and the D.S.O.

His long spell of active service in the field in all weathers had worn him greatly, and it was sadly necessary for him to try to recoup his strength. He spent some time at a sanatorium for consumptive cases, and, when allowed to return to duty, he had to recognize that service anywhere but in the dry climate of South Africa was no longer possible for him. So in May, 1903, he was appointed Division Officer at Bloemfontein as well as O.C. 38th (Field) Company, R.E.

The last seven years of his life Bowen spent at Bloemfontein. All these years he felt himself losing strength and as, one by one, his sports and games were taken from him, he could not but realize how near the end was drawing. Yet he never lost heart. His letters to those who knew and loved him always breathed the spirit of confidence and cheerfulness, and, to the end, his Irish humour stood by him. Twice during these last years he came home on leave and we saw the old flame burning as brightly as ever. In him, at least, the spirit was the master of his body and the ruler of his destiny.

One of his best and oldest friends writes of Bowen :—"I hold him in my mind as the best friend I ever had. . . . He was one of those you could always take up where you last left him and always find him the same. Always a leading spirit in every summer game and devoted to hunting ; so keen indeed at games that he played through a tennis tournament with whooping cough, the game having to be adjourned occasionally for him to get over his coughing fits. In Bermuda, where we served together, he was the life and soul of the Happy Valley, and equally as a sailor, a cricketer and as an actor he was always working his hardest. . . . Again at Bloemfontein after the war I found him doing most of the work in connection with

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the cantonments at Tempe. He had the most indomitable pluck and, however ill he may have felt, he was always working like blazes. . . . A true Christian, in the highest sense of the word and, I think without exception, the finest character I have ever met. How many of us could live for years under the curse of a disease which he knew must prove fatal sooner or later and still retain the strongest sense of duty, always sacrificing rather than sparing his strength, making light of all his difficulties, and always cheerful and sympathetic. . . . He was a firm friend, a thorough sportsman, a first-rate officer and an example to be followed."

Some aspects of a man's character are best and perhaps solely known to those who have served under him. To one such, and indeed to all his subalterns, he has ever been a true influence and teacher. By his example he always led us the right way and he possessed in full the rare and difficult art of compelling enthusiasm for the work of the unit, and for the soldiers who composed it. Nor did anyone know better than he how greatly its games contributed to the efficiency and comradeship of a unit, and he would give up every private pleasure to attend and, while he was able, to join in his company cricket match. All those who have served under him owe him much which they can now never repay.

A good deal of Bowen's service was spent in close contact with officers of other corps and regiments; with these he was always great friends and he was fond of impressing upon us how necessary it was to make efforts to be friendly with every branch of the Army. He will not be forgotten by those of the Berkshire Regiment with whom he lived in Bermuda, nor by the numerous officers of cavalry whom he used to teach at the Field Troop Instructional Camps near Christchurch.

Perhaps it will not be out of place to quote a few sentences from letters written whilst in South Africa, as they give a good idea of the character which this Memoir has attempted to pourtray :—

PRETORIA, *June 16th*, 1900.

. . . We do not know if the end has come yet and I am busy as a matter of fact in refitting the wreck of the troop for another four months' campaigning. . . . I thought the Vaal River would be the end of me —I spent hours wading about it—I was seedy for a few days then, but actually had not time to go sick. The result is that I recovered and am now in the best of health and spirits. I am rather too cold, although it is 12 noon, and the nights are too awful sometimes. . . .

WONDERFONTEIN STATION, *August 22nd*, 1900.

. . . As for myself, as you express it, I am (thank God), a hardened old ruffian and smoke my pipe of peace as usual in order to keep my

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temper unruffled. I felt a bit seedy at one time but some unexpected and unwelcome night marches and drifts to make good gave me no time to think of my ailments. When we came to a rest camp, I found I was not so bad after all. . . . We are not yet calculating on our rewards. We are waiting to get out of reach of shot and shell before we do so. You say "I ought to get something good." Well, even if I get nothing, it is a source of great satisfaction to me that my unit, which was supposed to be doomed before I took it over, should have done itself justice and that it has been found necessary to add two or three other field troops to the Army. . . .

BARBERTON, *September 26th*, 1900.

I suppose all things have an end and that some time or other our "trekking" will be a thing of the past. Well I have brought my field troop through to this. We are again suffering from the heat. Owing to the indomitable perseverance of the Post Office people, parcels are coming through. What do you think they contain? Jerseys and warm clothing! I am horrified. . . . I think I shall bury them. . . .

The troop is going strong. I was ordered to form four field sections out of it. I scratched my grey head a bit but I did so. Then they bagged two of the sections and proclaimed them as "The 4th Field Troop." As both these sections were on detachment from me at the time, you may imagine the glorious confusion it has brought my pay lists and store ledgers into. . . . Very grey, rather thin, and somewhat more lugubrious-looking than of old. . . . I am interrupted by the arrival of a train. I am general manager of a railway. . . .

VENTERSDORP, *December 24th*, 1900.

. . . As you see from my address, I have changed my locality. I have been on the trek for 18 consecutive days—as hard a three weeks as I have had in the campaign. I have now got my whole troop together with a force of four cavalry regiments, two batteries, R.H.A., a battalion of Scots Guards and some field guns. We have been hunting the Brother, but have again failed to catch him. I am not only C.R.E. to this big army but also Intelligence Officer; this means a lot of work and much riding. I provide guides for every cavalry patrol and question all prisoners brought in. I am hard at it night and day and really am beginning to feel the need of a rest and some relaxation. I have put in a hard 14 months. . . .

We are now in the open veldt, 25 miles from the railways. We get no mails and no news. We have overtrekked and have *many* sore backs. Horse sickness is appearing and the cavalry are dropping horses daily. Life is only relieved from utter monotony by such misfortunes. . . . The weather is very hot and our marches and work so boring that I am really surprised at my remaining in the most vulgar good health. I think constant little worries keep me from feeling any complaints. . . .

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PIET RETIEF, *February 19th*, 1901.

. . . Our convoy is 24 hours overdue and has not been heard of yet. If it does not come in to-morrow, we shall have to feed on meat and mealies—as Brother Boer has done the same for some months I suppose we can subsist for some days on this fare. Of course our mess stores are at a low ebb and we do not live luxuriously even when on full rations. I am very contented and happy at present notwithstanding four consecutive wet days and with no (officially but not practically) tents to get shelter in. I have plenty of work to do as Intelligence Officer and at fortification of posts, drifts and water supply. . . .

STEYNSDORP, *May 27th*, 1901.

. . . This is a collection of about a dozen ruins and a dozen corrugated iron shanties. It is not even favoured with a church, but it has beautiful water about it, and water is, in my opinion, the only thing that differentiates a good place from a bad place in South Africa. We struck a beautiful garden of orange trees on our arrival this morning. There are no oranges now. . . . I wonder when I shall get home. There seems to be no end of it for me. My troop is a most useful one, under present conditions, and is bound to be kept at it as long as there is an enemy to be hunted down. I want to see it out and to bring home my men, but I feel just a little sick of it. . . .

NEAR CAROLINA, *June 30th*, 1901.

. . . We still "trek, trek, trek." Boers in small parties are always in sight but, out of range and there seems to be no ending to their infernal obstinacy. We have now been on the march continuously for two months. Our horses are worn out and our mess stores very scarce. We long for a short rest on the railway to enable us to refit and recoup a bit. . . .

My time in the field troop is nearly up. I have certainly had the honour of bringing it from a very humble position, threatened with abolition, to an important place in our Corps. Of course luck favoured us well and it only wanted good fortune to bring the troop into notice. I am glad I had the command of it through this critical time of its career, although I take no credit for its success.

MIDDLEBURG, TRANSVAAL, *February 2nd*, 1902.

. . . I have (thank God) stuck to it so far and I will bring the old field troop home if I am allowed to do so. . . . I have just lost my old pony from horse sickness. If I mistake not he had six clasps and Sapper Parsons won his D.C.M. on his back, so I am sorry for him.

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MIDDLEBURG, TRANSVAAL, *April 12th*, 1902.

. . . I now lead a sedentary life. . . . I still have the success of the troop at heart and do my utmost to work it up, but I have not sufficient scope for my energies under present conditions.

Now we hear rumours of probable peace. I wish we could believe them. We have heard them ever since our arrival in Pretoria in June, 1900. Driver Rose used then to inform me that "Old Kroojer had giv' in," when I inquired the cause of cheers in the camp. The latter was generally due to an issue of rum being made to some corps. Since that, rumours of peace are always flying about but they have never led to any substantial improvement in affairs.

MIDDLEBURG, TRANSVAAL, *May 22nd*, 1902.

. . . We are still in the throes of excitement as to whether it is to be peace or war. It quite reminds me of the old days in September and October, 1899. Now however our wishes are entirely for peace. Then some of us had a lurking desire for war. We have had about enough of the latter. . . . Are we to stay out here another eight months or shall we see the Duhallows next season? . . . It is hard even for you to appreciate the hardness of over two years on the veldt, living on plain fare, up at daylight, always worried with heat and rain, monotony only broken by bullets and mails at long intervals. Add to this the care of horses, the keeping of returns, the making up of equipment and the life of a trekker is complete. It is a grand life for six months or perhaps 12. I never thought that when we landed here at the end of 1899 I should be putting 1902 at the top of my letters before leaving the place. . . .

(AFTER THE WAR). BLOEMFONTEIN, *October 18th*, 1903.

. . . The doctors mark me "Unfit for Active Service," so that I feel that my field troop days are over and that I must be content, for a few years, at any rate, to enjoy a quiet life. I would retire if I could afford to quarrel with my bread and butter, and settle down by a trout stream in the Duhallow country. . . .

BLOEMFONTEIN, *September 28th*, 1906.

. . . I have lost most of my ambition, although I still do my job to the best of my poor ability. . . . I am very fit. Wonderfully so, considering the conditions. I "make a noise," and do not pass the vet., but I hope that I am still a fair hack in H.M.'s Service. . . . We have a good company here and excellent cricket and football. They are too much for me now, but I make a good armchair critic of the performance of my subalterns. . . .

Few officers have more bravely lost their life in the service of their country than did the author of these letters. Such careers as Bowen's, equally with those of men better known to fame, are to be treasured as landmarks of the past and examples for the future.

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TRANSCRIPT.

GENERAL REPORT ON THE ENGINEER TROOPS OF THE ITALIAN ARMY.

By Capt. Don Rafael Marín del Campo.

(Translated from the *Memorial de Ingenieros*, January, 1910).

The author was attached to various engineer units of the Italian Army from July, 1908, to the end of June, 1909, and the following report is the result of his observations.

I. Mission and Equipment of the Engineer Troops.

Sappers.—Each company possesses the following articles of field equipment:—

1. One sapper field park, composed of five 4-wheeled wagons with entrenching, mining and office equipment.

This park is to be abolished and is to be replaced by one consisting of six Alpine carts, small carts which offer many advantages, the principal of which are the following:—Suitability for all kinds of ground; in case of need the load of each cart can be transferred perfectly and entirely to the backs of two pack animals; and lastly in case of requiring to retreat in difficult ground the shafts can be unshipped and fitted again to the back of the cart so that it is unnecessary to turn.

2. A bridging section of 7 wagons, viz.: 4 pontoon wagons, 2 trestle wagons and 1 field forge, sufficient to form 44 yards of bridge with four fixed and two (four halves) floating points of support. Its duties are identical with those of a Spanish sapper company; but, in addition, advanced guard bridges are made with the material just described.

A part of the portable technical equipment is carried by the men. It is divided into 17 groups, to each of which there corresponds one or more tools or instruments (levels, telemeters, tape measures, wire, shovels, picks, mauls, etc.), which can be carried by a single individual, and which are provided with cases, straps and other requisites necessary to facilitate their convenient transport and to avoid damage.

In all, a company carried 98 articles of technical equipment in peace and 196 in war.

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Lastly, and apart from all the above-mentioned stores, the Italian Army possesses a certain number of yards of Eiffel metallic bridge for highways and ordinary roads, which the sappers erect with extraordinary rapidity, and which will probably soon be replaced by another pattern due to Engineer Lieutenant Sr. Genesio.

Miners.—The Italian miners form the true Alpine engineer troops.

Formerly the engineer commands were charged with the duty of preparing or inspecting, in time of peace, projects and works for destroying lines of communication on the frontiers, which the sappers had to carry out in time of war. Taking into consideration, however, that there were many independent engineer commands, and that therefore they were unable to comply with this duty in a uniform manner, and besides that, as they were engaged with the construction of many important fortification and barrack works, they gave only a secondary place to these demolition projects, and further that as the regiments of sappers had numerous tasks to perform and more especially to deal with all bridging matters it was practically impossible for them to receive the training required by mountain engineers, for all these reasons, it was decided to form the Regiment of Miners, and this was done in the year 1895.

The writer expresses great pleasure at the forethought and care with which this regiment carried out the very difficult duty of interrupting lines of communication.

The Italian frontier is divided into two main parts, the Eastern or Austrian, and the Western or French. As far as the miners are concerned, each of these parts is divided into 12 zones, assigned respectively to the 12 technical companies of the regiment. Each company is in charge of two zones, one on each frontier, and in them year by year it studies the works which must be made in peace time, maintains and visits the numerous magazines of demolition stores, about 100 in number, which are established there, lays down the defensive conditions required for the communications, and proposes such new interruptions as are deemed necessary, variations in the existing ones, etc., etc.

All this work is examined, co-ordinated and centralized in the regimental office, which is perhaps the busiest and most responsible of all in the Corps of Engineers.

When war is declared or expected, the companies of miners at once start off without waiting to complete their strength from the reserves, and, with the stores which are contained in the small magazines above referred to and with those in their wheeled parks, they charge the mines and get everything ready for firing them as soon as orders are given to that effect.

The wheeled park of each company consists of six Alpine carts, similar to those of the sappers but with an equipment not altogether identical.

The officers are always studying, experimenting, modifying and inventing various kinds of explosives, exploders, fuzes, detonators and other stores connected with their duties.

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Pontoneers and "Lagunari."—Apart from the two companies of "lagunari," which the writer did not visit, and the duties of which are to provide the transport services in the fortress of Venice, the eight remaining technical companies of the regiment are pontoneers, similar in every way to those of the Spanish Army, except for the fact that the sappers have the advanced guard bridging trains.

The train of each pontoon company is capable of making 220 yards of bridge. In all, the regiment has 12 of these trains, *i.e.* 2,640 yards, which combined with the 1,760 yards held by the sappers gives a total of 4,400 yards of bridge in possession of the whole army. The existing type is the well-known Birago, which, though old, is so well used that extraordinary results are obtained from it.

The regiment has been experimenting for some years with a new pattern of bridge, of Italian origin, of which they speak very highly, and which it appears will offer two striking and characteristic qualities, namely:—first in the material itself by the introduction of a very ingenious and practical trestle, and secondly in the organization of the train, in which each wagon will transport the stores necessary for the construction of one bay.

This is not the only experiment that is being carried out by the regiment; trials are also being made with a modification of the existing bridging section of a sapper company and the production of another much lighter to accompany the cavalry.

Railways and Motors.—The brigade formed by these troops is really a regiment, which includes absolutely the whole of the military railway and motor services of the nation. These troops, since their formation, have never ceased training, and have constantly transformed their *matériel* and instruction in consonance with the new principles which have been evolved in regard to military transportation.

Originally the Italian railway troops devoted themselves to laying normal lines of railway, working them, and constructing platforms and bridges. Some time ago they acquired a quantity of Eiffel metallic bridging material, and in consequence have added to the above-mentioned duties those of erecting and dismantling this class of bridge.

Later on, in view of the great waste of time which takes place in the field in constructing platforms, they commenced to study the question, and after many attempts produced the type of portable metal platforms, now adopted in the service, which are exceedingly practical, convenient, light and even elegant. Fifty men can construct 100 square metres of these platforms in three hours.

At the time when portable railway lines were much talked of, the brigade acquired a certain quantity of material of the kind, but it was found of no use owing to the heavy gradients of the Italian high roads on the frontiers.

Recently some Wells lights have been obtained for illuminating

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stations made from the portable platforms referred to above, and for all kinds of night work.

Finally the appearance of the motor has solved a problem, which portable railroads were unable to do, and every day adds to the importance of the motor car.

Each railway company has its park, composed of 4 store and 1 supply wagon the object of which is to transport the tools and materials required when they cannot be taken by rail. They are approximately similar in design to the 4-wheeled wagons of the sappers.

In addition to these parks, the brigade is in possession of the undermentioned stores, which are ready to be sent wherever required: 5 Eiffel metal bridges, 550 yards of portable metal platform, 30 Wells lights No. 3, metal bridges for portable railways, 27 motor lorries of 15, 18 and 24-H.P., 24 motor cars of 16 to 24-H.P., 7 motor cycles, 2 steam wagons. The brigade works 2 standard gauge lines which belong to the State Railways, of a total length of 50 miles.

Telegraphists and Specialists.—This regiment is without doubt the most important of the Corps of Engineers and perhaps of the whole Army, not only on account of its strength (more than 2,300 men) but also on account of the variety and importance of the duties assigned to it.

Its companies are divided into three groups:—Specialist Brigade, Fortress Brigade, Field Companies.

The Specialist Brigade consists of 2 balloon companies, 1 photographic and 1 wireless section. The writer did not visit it, so confines himself to saying that in the autumn of 1908 it acquired its first dirigible which has proved most successful.

The Fortress Brigade is composed of 3 strong companies, in all 750 men on a peace footing. It is charged with the duty of providing the telegraph services of the land and coast fortresses in war time, and is organized in a manner somewhat similar to the Regiment of Miners.

The 9 remaining companies are field companies, and are destined to accompany the field army. The park of a company consists of 6 vehicles with electrical stores, 3 for air line and 3 for cable, 4 optical signalling vehicles, 1 reserve vehicle, 1 field forge, and 2 supply vehicles, 8 bicycles and 50 horses. It contains altogether 27½ miles of line, 12 telegraph stations, 12 telephone stations, 5 optical stations, with 8 spare telephones, 1,100 yards of wire, 1,320 yards of submarine cable, besides posts, insulators and everything necessary.

This park will soon be replaced by another composed exclusively of Alpine carts similar to those of the sappers and miners.

The Morse station is very like the Spanish one. The battery used is the Marie-Davy in boxes of eight cells, which is soon to be replaced by a dry battery designed and constructed in the central engineer workshops, and which possesses many advantages. The existing telephones will also

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be replaced by the new micro-telephone apparatus which has also been designed and made at the central engineer workshops. This, like the new battery, is excellent as has been proved both on manœuvres and in the shops. The reel for laying out the line is so simple and so convenient as to deserve mention. The really interesting and characteristic part of the equipment is the optical material. It is purely Italian and is due to the Engineer General Sr. Faini.

The heliograph and dioptric are enclosed in the same box, and both are worked by the same key. The dioptric apparatus is provided with both acetylene and oxy-hydrogen lights. A compass and prism serve to set the apparatus. The box is of aluminium sheet, varnished black. Its size and weight are insignificant, so that a complete station can be carried in two knapsacks of ordinary size, one containing the apparatus itself, the other the accessories.

The optical cart has 2 wheels, and is drawn by 1 horse. It gives to the station, together with the 2 telephones which it carries and the 2 cyclists who accompany it, a mobility and utility, the advantages of which are so great that it is useless further to dwell on them. In fine, optical telegraphy has reached an enviable standard in Italy.

The Alpine troops are not the only ones that possess telegraph and telephone instruments, and the present tendency is to disseminate these means of communication amongst all the troops, though the Telegraph Regiment will remain with its special functions and as the centre of instruction and experiment.

The military pigeon lofts are also on charge of this regiment.

Since the writer left Italy the Specialist Brigade has been taken away from the Regiment and formed into an independent unit.

Train.—Each engineer regiment has, in addition to its technical units, one or more companies of train (10 altogether for the engineers) charged with the care of all the animals, vehicles and transport. These companies disappear on mobilization, and are divided up into sections which are attached to the technical companies, the captains of which become responsible for all services.

Engineer Workshops.—The central workshops are at Pavia, and are in no way remarkable in appearance. Their output however is most praiseworthy.

With the exception of motor cars, balloons, photographic apparatus, wireless installations and explosives, practically all engineer stores are made there. They turn out sapping, mining, bridging and railway material, very delicate telegraph and telephone apparatus, the Faini optical instruments, Morse stations, micro-telephones, dry batteries, etc. In addition bicycles are made there for the whole army, a most important undertaking in view of the great development of this means of locomotion.

Each regiment has its own regimental shops, where stores are repaired.

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In spite of the modest character of these shops, many trials and experiments are conducted in them. The Specialist Brigade also makes its own dirigibles.

General Observations on Technical Material.—Pack transport is only employed exceptionally.

The regulation pack saddle which is always carried in the parks of the sappers, miners and telegraphists is of a single type and serves for every kind of load. It is very simple and practical and many valuable lessons may be drawn from an examination of it.

The amount of engineer field material which Italy possesses consists of:—One park for each company of the permanent army and mobile militia; the army corps parks, each composed of 13 vehicles; the army parks of 35 vehicles.

The organization of the parks has been studied with the greatest care and in the smallest particulars. More than one detail can be cited to confirm this statement. The Alpine carts are specially worthy of notice.

The quality of the material is always good, in many cases excellent, sometimes perfect.

One of the most noticeable points is the tendency to make the supply of material quite independent of foreign aid, this is a faithful reflection of the spirit of private industry, which becomes every day more prosperous and more national.

The Genesio Bridge, the new pontoon material, the universal fuze and other inventions of General Spaccamela, the Cantono exploder, the Faini optical signalling apparatus, the battery and micro-telephone, the metal platforms, the military dirigibles, etc., etc., are examples of regulation equipment due solely and exclusively to the officers of the engineers. This is without counting the work of many officers, which is being brought to a satisfactory conclusion at the present time, and the valuable co-operation of private industry. Thus within a very short time there will be almost no article of engineer equipment which does not satisfy the two requisites of being made and invented in Italy.

II. Life in the Regiments.

I now propose to explain certain details which are apt to be overlooked amidst those that are more striking, in order that the reader may form a general idea of how the engineer troops employ their time, and what they look like.

General Distribution of Time.—The year is divided into certain seasons, which vary according to the special functions of each regiment, but the general lines of the distribution are always the same.

The following is the usual division of the year:—

1. November to January: separate training of the recruits and trained soldiers.

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2. February to the end of winter: general training and elementary technical work.

3. Spring and summer: training reaches its maximum development, and the great engineer exercises take place.

4. August and the beginning of September: general manœuvres, at the end of which the senior draft of the regiment is discharged.

5. Middle of September to end of October: training of the recruit instructors and ordinary training.

The companies train independently of one another, and their respective captains are actually responsible for the instruction.

The majors act as inspectors of their commands, and the colonel supervises the whole of the instruction and marching of the regiment, for which purpose he makes occasional visits to the permanent detachments.

Thus the general time table for the regiment, which is drawn up by the colonel, merely indicates the hours of reveille, retreat, meals, etc., without specifying the hours of drill or training. These are fixed fortnightly by each captain according to his own judgment, a detailed programme for each day of the two weeks being drawn up by him on a half sheet of foolscap.

The general training manual for the army deals solely with matters common to the whole of the engineers and with those proper to its various branches. In addition there is a separate manual giving all kinds of data, such as the more important formulæ, and in a word all that is required in a work of this kind.

Thus, for example, there are manuals for the use of cordage, for the construction of improvised machines, for the passage of small water courses, for roads and camps, etc., etc. In the Italian Army there is a manual for every subject, however unimportant it may seem.

The colonel of the regiment draws up an annual programme of instruction, in which the work that is to be done in each period is noted. The captains are required to ensure that their companies shall have attained the necesssary proficiency in each subject by the end of the period allotted to it, but they are left the greatest freedom in employing whatever means they may consider most suitable for gaining that end.

The following characteristics of the Italian Army should be noted:—

(1). The scrupulous pains with which the training manuals are edited and constantly brought up to date, those that are now in force are based on the lessons of the Anglo-Boer War, and new editions are being prepared which embody the lessons of the Russo-Japanese War.

(2). The freedom of initiative and the consequent rational devolution of responsibility.

Recruits' Training.—As indicated above, the month and a-half which intervenes between the passing to the reserve of the senior contingent

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and the entry of the recruits, is devoted to the training of the recruit instructors.

It is unnecessary to say anything here either about this training, or about that of the recruits themselves. It is sufficient to say that it is based on the principles which have been adopted by the German Army, which in this, as in so many other matters, is copied for better or worse by all the world. The reader is therefore referred to the excellent work of Capt. Don Carlos Requena entitled *Nine Months in the German Army*, of which the first part is devoted to the training of the recruit.

At the end of this training the Italian engineer recruit possesses:—A knowledge of the rules of discipline, of interior economy, of garrison duties, of hygiene and of the penal code, of uniforms and equipment, of military and civilian rules of courtesy and conduct; he has been instructed in gymnastics, in tactical movements in close and open order, in marches and in elementary duties in the field, and in care of arms, aiming drill and the firing exercises. The special technical training of the regiment is begun a few weeks after the recruits have joined, but very little attention is given to it during the recruit period, and only the elements are dealt with, such as, for instance in sapper units, knotting, use of tools, and a little about boating, camping, etc.

At the end of the course the colonel carefully examines the recruits, company by company, in presence of the officers, in all that they have learnt, except technical subjects. This examination serves as a means of forming a judgment on the efficiency of the captains.

Training and Life of the Soldier.—The Italian soldier is smart in appearance; he always holds himself erect, and even when standing in the middle of the street, he seems as though he were awaiting the word of command "quick march."

This is due to the following causes:—(1), He spends the whole day under instruction and leads an active life in the open air, which tends to strengthen his body: (2), he is constantly engaged in gymnastics either with or without apparatus, and in the regulation gymnastic games which make him strong and well set up: and (3), the preliminary tactical movements, such as changes of front and of formation, make his step light, and accustom him unconsciously to be always ready to march to his front in a resolute and energetic manner. The correctness and elegance of his appointments must also be noted, and the simplicity and practical nature of his uniform. In a word, in these regiments everything is subordinate to training, which in itself constitutes the real life of the soldier.

It may be said that of the 24 hours of the day eight are devoted to instruction, nine to sleep, and seven to meals, rest and recreation. The distribution of time is not the same in winter as in summer.

Taking the 1st Regiment of Sappers as an example, let us see how the day is apportioned in the summer.

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The men proceed to the drill ground at 5 a.m., where they remain under instruction until 1 p.m., with an hour and a-half (from 9 a.m. to 10.30 a.m.) for breakfast and rest. Afterwards the companies return to barracks, and are allowed to take a short siesta. The evening instruction is from 3 to 5 p.m., either in the barrack square or on the drill ground as in the morning. Dinner is then served, and the men are free until retreat.

In winter the first instruction, up to breakfast time, takes place in barracks, as the drill ground and the neighbouring river are generally covered with a thick mist. At about 11 a.m. the troops go down to the drill ground and remain there till dusk.

At the close of the recruits' course, the various subjects of training are taken up gradually and simultaneously, that is to say the soldier is trained equally in gymnastics, tactics, marches, technical subjects, etc.

The regiments are provided with beautiful and adequate drill grounds in the environs of the barracks, where they can be trained in all subjects except musketry and marching, but inclusive of bridging.

On Saturdays training ends a little after midday, after which the troops are engaged on fatigues, cleaning their equipment, and kit inspection.

On Saturday evenings or Sunday mornings, according to the garrison, conferences are held under the captain of the company on the moral education of the soldier, and last one hour. The captain always commences by making a sort of balance sheet of the work of the past week, points out the faults which have most displeased him, and expresses an opinion either favourable or the reverse on the progress made by the unit in general and by individuals in particular. After that he relates stories of war or of national history, or gives a discourse on moral, social or military questions, always with a highly educative object.

Within the last few years recreation rooms have been established in all the barracks in Italy. They consist of one or more rooms, larger or smaller, better or worse furnished according to circumstances, but which are always much appreciated.

They contain books of various kinds, games such as chess, draughts, dominoes, etc., writing tables, ink and paper, and are lighted and warmed. In summer they are but little used by the troops who prefer to go out in the cool of the evening, as is only natural, but in winter they are always filled during the hours of leisure.

How many benefits, these recreation rooms confer on the army! I remember that the one belonging to the Regiment of Miners impressed me most favourably with its order, perfect cleanliness and good taste, and with the relative luxury with which it was equipped, and in which one could see the hand of its former colonel, now General Spaccamela, whose devotion to the service is so well known.

The regimental band plays for a long time every Sunday morning in the barrack square. On the mornings of holidays soldiers' sports are

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held with gymnastic competitions, races, jumping, bicycle races, and various games. These are quite apart from the regular gymnastic competitions which are held annually.

Besides the national festivals, the engineers celebrate the feast of Saint Barbara, their patroness as well as that of the artillery, and the 13th February, the anniversary of the taking of Gaeta.

On both of these days and on some of the others, the sports or gala dinners are opened in a manner which deserves attention. After the review and march past, an officer with a loud voice ascends the tribune which has been specially prepared for the purpose and gives a lecture on the feat of arms that is being commemorated, or if the holiday is not such an anniversary he describes some other warlike episode. Thus by the end of his three years' service the soldier has listened to the narration in solemn fashion of a number of events calculated to awake in him a love of his country and of the army.

Officers and Non-Commissioned Officers.—It will not be necessary to say much now about the officers, as the third and last part of this paper will be entirely devoted to them.

Special and separate schools of instruction for officers and N.C.O.'s are held in barracks and garrisons during the autumn and winter.

The following is a programme of the instruction given to the officers of the Telegraph Regiment during this period in 1908–9, and which was attended by the writer. Similar courses are held in other regiments.

1. Conferences and lectures on technical military subjects for all officers (two hours a week).
2. War games, also for all officers (two hours a week).
3. Fencing and gymnastics for captains and subalterns (one hour a day).
4. Practice in the transmission and reception of telegrams (one hour a week).
5. Special instruction on the mobilization of the regiment given by the colonel in person on certain days.
6. Revolver practice and competitions on certain days.

The daily fencing and gymnastic exercises take place during the time of rest given to the men in the mornings, and the remainder of the instruction after the troops have finished their work in the evening.

This alone will give a sufficiently clear idea of the Italian officer who, let it be said to his honour, consecrates himself body and soul to his profession.

The N.C.O.'s receive instruction in an analogous manner, the subjects being map reading, accounts, fencing and gymnastics, study of the chief regulations, revolver practice, and competitions.

In addition there is a weekly conference at the Garrison Military Club for all officers, from the General Commanding the Army Corps to the

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last-joined subaltern. It usually takes place on Saturday evening, but if on a different day, then at the conclusion of the work of the units at which all are bound to assist.

When I was in Italy, a short time after the first trials of the Italian military dirigible, the commander and several officers of the Balloon Corps travelled to all the principal cities and gave lectures to the officers of the garrisons on the results obtained. I had the pleasure of attending the one given in Florence which, in spite of its lasting two hours, was most instructive and was received with great enthusiasm.

There are Officers' and N.C.O.s' Messes in all barracks consisting of mess, billiard and other rooms.

No soldier is permitted to wear plain clothes: all officers of the same rank, no matter their seniority, *tutoyer* each other: the possession of a bicycle is very common amongst them: they are very frugal and abstemious in their habits: the bachelors usually take their meals at the regimental mess, or at the garrison clubs, these latter being very numerous, and kept up with care though no game of chance is ever played in them: it should be remarked that there is nothing frivolous or vicious about these clubs, which are in reality centres of culture, as well as very practical and well-organized restaurants.

Both the general and professional culture of the officers merits high praise. They are very skilful in map reading, as one of the subjects to which most attention is given is knowledge of ground and facility in the use of maps. In this connexion I would mention the excellent impression which I have gathered of the Italian Military Geographical Institute, which produces an extraordinary amount of useful work, and to which is due the large number of editions of the map of Italy, on various scales, which are constantly used by officers and men.

The appearance of the officers, like that of the men, is smart and soldierly: they always wear uniform, whatever their employment: they ride much on horseback and on cycles (all combatant officers, except infantry subalterns are mounted): they are devoted to all kinds of physical exercises: they rest but little; they rise early; and in fine live the splendid active life which is so well suited to the soldier.

Space prevents me from giving any more details concerning the lives of the officers whose first and foremost virtue is the assiduity with which they work at their profession, for both in the regiments, in the General Staff and in the War Office, the Italian officer spends the whole day in his professional duties, as has been indicated before. I shall not tire of repeating this lesson, for it is the principal one that I have brought back from Italy, and it alone is the secret and panacea whereby a commencement may be made in the conversion into great and strong nations of those which are otherwise.

I will say, however, before going on, that there is one appointment which is considered as an easy one, and is so when compared with others. I refer to the appointment of A.D.C. to a General. These appointments are, however, very few in number, as a General of Brigade does not have

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an aide-de-camp, whilst other general officers, including the Minister of War, have only one each, always a lieutenant of cavalry, who cannot hold the appointment for more than two years consecutively.

Manœuvres.—The annual manœuvres are of different classes, viz. :—

Garrison manœuvres.
Exercises of the separate arms.
Staff rides.
Field manœuvres.
Grand manœuvres.

It will suffice to give a few details of each in order to indicate their scope.

Garrison manœuvres take place in spring and summer. One day a week is devoted to them, and all arms take a part.

I have assisted at them in 1909 in Florence, where they were well conducted by General Della Noce, who commanded the division. At the time when they are begun, the recruits have between five and six months' service. They are intended chiefly for the instruction of the field and subaltern officers, whilst the field and grand manœuvres are chiefly for the instruction of field and general officers.

I remember that reveille was sounded a few hours after midnight, and that the troops returned to quarters at midday or in the afternoon. The picturesque and broken country round Florence is admirably adapted to the purpose.

Half-way through the first day of the manœuvres the halt was sounded, and the action of the artillery of one side was criticized on account of its having revealed its position by opening fire on the adversary, that is to say, attention was chiefly fixed on the scheme, on the general dispositions and on the choice of positions. During the other half, the action was allowed to develop and the work was more practical than in the first half, and the various phases of the fight could be studied better.

Field officers of different arms took turns in commanding the sides. Special ideas were issued to commanders on the previous night, a general officer acted as director, and the commander of the division, who was, as is always the case in Italy, also the military governor, supervised the whole of the exercises.

Regarding the exercises of the separate arms, I will say a few words about those of the engineers.

Their object and development are quite different from our annual courses of instruction in Spain. These latter do not exist in Italy, and, as has been already explained, it is considered that they are unnecessary, as the technical instruction of the troops continues all the year round.

Thus, for example, in the sappers, the tactical factors are given the most important place in these exercises, as works are executed and problems solved, not merely in accordance with technical requirements, but with special regard to the supposed tactical situation. The necessity

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and value of such exercises is fully understood, as they fill a gap which cannot be filled in any other manner, as means are lacking in the ordinary garrisons, and time is insufficient during manœuvres.

Every year the sappers hire a different training ground containing a stream and various hills, where these exercises are carried out for about a month, and the degree of instruction imparted during the previous months is ascertained.

The miners spend 90 days in the mountains.

The bridging troops spend their time in navigating a network of rivers on which they carry out manœuvres. It is regretted that space does not permit of a description being given of the very practical and curious way in which the two months which are devoted to this training are employed.

The railway, telegraph and special troops require no particular mention, as they can all practise their various duties as well at manœuvres as at other times and they therefore do not require special exercises, or at any rate not to the same degree as the other branches of the arm.

Staff Rides.—I attended the staff ride of the 8th Army Corps, which took place in Tuscany, when some 70 officers were present, the majority being general or field officers. There were two sides, each commanded by a lieutenant-general: major-generals and colonels were respectively in command of divisions and brigades, and the Commander-in-Chief acted as director of the ride, which lasted a week. Horses, carriages and trains were used, as required, for getting about the country.

I will say nothing about grand manœuvres as I have not taken part in them.

The field manœuvres which I have attended were those of the 3rd Army Corps, in which its two divisions took part on opposite sides, complete in themselves and with the corresponding administrative services.

I would call special attention to the ease with which the Italian Army marches, camps and manœuvres.

Those who have lived in that army attribute this fact to various causes such as the atmosphere of mobilization which exists, as everyone down to the captain of a company is constantly preoccupied with his schemes of mobilization; the constant life of practical training which is passed in the garrisons; the importance given to map reading and to study of the ground; the portable shelter tent which is carried in this as in almost all armies; the custom of carrying out all tactical training and marches, however insignificant, in full marching order; these are reasons which are sufficient to ensure that this or any other army shall not tire itself when on the march, camp under bad conditions, or manœuvre sluggishly.

At manœuvres all officers always carry a wallet hanging from the belt. It is a very practical and useful means of carrying plans, drawing materials and various papers.

Conferences are held each day at the close of garrison manœuvres. At field and grand manœuvres they cannot be held in the same manner, owing to the impossibility of collecting daily the officers of both sides.

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The conference on the manœuvres of the 3rd Corps, already mentioned, took place only at their conclusion. It lasted four and a-half hours, and I shall never forget the solemn impression it made on me. The director of the manœuvres, General Mainoni, showed clearly on this occasion that however great were the liberty and initiative which he had conceded to the generals in command of the two sides, he knew well how to express his opinions with absolute frankness, whether they were favourable or the reverse.

At the end of the manœuvres and as a consequence of them, the confidential reports of officers are revised and brought up to date.

'M.'

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RECENT PUBLICATIONS OF MILITARY INTEREST.

APRIL, 1910.

(*Published Quarterly*).

THE following extracts from the list compiled by the General Staff, War Office, are published in the *R.E. Journal* by permission of the Army Council.

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PART II.

SECTION I.

AERIAL NAVIGATION.

DIRIGIBLE BALLOONS (Les ballons dirigeables). By Lieut. Archer. 40 pp. 8vo. Paris, 1908. Chapelot. 1s.

This pamphlet is worthy of study. The author shows by calculation that an ordinary spherical shell, 33 centimetres in diameter and weighing 60 kilogrammes, falls 1,500 metres through the air in 19·5 seconds and that the lateral pressure of a wind blowing at the rate of 22 miles per hour will only cause a deflection of 10 metres. He also states that it has been proved by actual experiment that a weight of 750 kilogrammes can be discharged from a balloon of the "La Patrie" type without endangering its stability.

From a height of 400 or 500 metres, 50 per cent. of the projectiles discharged have actually been placed in a square of 25 metres side.

Artillery fire at a balloon is also discussed. The author underestimates the damage which might be inflicted by shrapnel bullets, and is of opinion that ordinary field guns will be of no use against dirigibles owing to the flatness of their trajectories.

A HISTORY OF AVIATION (Histoire de l'aviation). By M. Turgan. 280 pp., with numerous diagrams and illustrations. 8vo. Paris, 1909. Geisler. 4s. 2d.

A very complete history of aviation from the times of Icarus to the present day.

It should be explained that the term "Aviation" in France is strictly limited to flying machines which are heavier than air. Unfortunately in this country the word has been adopted to describe aerial locomotion of all kinds.

The first three chapters bring the history of the subject up to A.D. 1850.

The fourth chapter deals with the period 1850 to 1900, and mentions no less than 93 different inventors. It is divided into three parts dealing respectively with Ornithopters, Helicopters and Aeroplanes.

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Chapters V. to VIII. deal with the period 1900—1909. This portion of the book contains much useful information relating to successful aeroplanes, and is therefore of interest to the designer as well as to the student of history. Some particulars are also given of 25 aeroplanes and 10 miscellaneous machines, which, at the time of publication of the book, had not been tried.

An appendix gives short descriptions of the best aviation motors.

THE ELEMENTS OF AVIATION (Éléments d'aviation). By Victor Tatin. 70 pp., with illustrations. 8vo. Paris, 1909. Dunod & Pinat. 3s.

A good book for anyone who contemplates designing an aeroplane. The laws of air resistance are explained, with the use of the most elementary mathematics, sufficiently clearly to enable the reader to design an aeroplane that will fly.

The author is not without his prejudices, but his views are, on the whole, orthodox.

The short chapter dealing with the early history of the subject is interesting chiefly on account of the appreciation it contains of the work of Sir George Cayley.

ALL THE WORLD'S AIRSHIPS. By F. T. Jane. 374 pp., with numerous illustrations. Fol. London, 1909. Sampson Low. 17s. 6d.

This is the first issue of a publication which is intended to be for the air what "Fighting Ships" is for the sea.

Part I. contains a record and description, so far as is known, of all aeroplanes and dirigibles completed and under construction, and is arranged by nationalities in alphabetical order. Where possible, illustrations are given and details with regard to construction and method of propulsion, etc. Representations in silhouette of the various dirigibles are also included, and are drawn at a uniform scale, but the characteristic features of each are slightly exaggerated in order to facilitate recognition.

Owing to the secrecy that is maintained by inventors this Part is necessarily very incomplete, but it is useful for reference, and the value of subsequent editions will increase as the science of aviation develops.

Part II. contains articles on aviation, and includes one by Mr. C. de Grave Sells on aerial engineering which describes the progress in this branch from 1852 up to the present date.

DETERMINATION OF CONCEALED OBJECTIVES BY MEANS OF THE CAPTIVE BALLOON (Détermination des objectifs dérobés aux vues au moyen du ballon captif). By Lieut. H. Chaumont. 70 pp., with 20 figures. 8vo Paris, 1909. Berger-Levrault. 1s. 8d.

This book shows the methods by which telephotography from a captive balloon can enable siege artillery to fire on concealed targets. Since a captive balloon has to be at least 5,400 yards from the enemy's battery, the photographic apparatus must be capable of obtaining images of objects from 5,400 to 7,500 yards distant, and it is absolutely necessary that the exposure should be as short as possible, at any rate not more than $\frac{1}{50}$th of a second.

The author then explains his own methods of fixing on a map the object disclosed by a photograph taken from a captive balloon. He discusses, with diagrams and mathematical calculations, various cases: (*a*) when the photographic plate is vertical at the time of exposure; (*b*) when it is inclined; (*c*) when two photographs from different places are taken; (*d*) when only one photograph is taken. Then he explains how telephotography can show the elevation of an object. Finally he points out that only an artillery officer can observe artillery fire, so that artillery officers must be trained in balloon work and telephotography.

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CAVALRY STUDIES (Kavalleristiche Studien). By Major-General M. von Czerlien. 77 pp., with sketches in the text. 8vo. Vienna, 1909. Seidel & Son. 2s.

The author of this pamphlet is well known in Austria-Hungary as a writer on cavalry subjects, contributions from his pen having appeared from 1880 onwards.

The present publication contains four separate studies:—

(1) Cavalry machine guns at the 1908 manœuvres in Austria-Hungary. (2) Modern artillery in conjunction with cavalry. (3) A cavalry attack upon infantry at the German manœuvres in 1908. (4) The German Cavalry Regulations, 1909.

Of the above studies the first is of little importance as it is merely based upon far fuller articles by Capt. Viktorin which have appeared in *Streffleur's Magazine*. The second occupies more than half the pamphlet and is perhaps the article most worthy of study. The third describes an occasion in the German Manœuvres of 1908 when an opportunity was offered for a cavalry attack upon infantry on a large scale. The fourth study contains merely a few notes and comments.

FORTIFICATION AND MILITARY ENGINEERING.

REGULATIONS FOR SIEGE OPERATIONS (Instruction générale du 30 Juillet, 1909, sur la guerre de siège). Official. 92 pp. 8vo. Paris, 1909. Lavauzelle.

These new Regulations which supersede those of the 4th February, 1899, are divided into two main parts, viz.:—Attack and Defence. Each part is further subdivided into (*a*) General Principles; (*b*) Organization of the Army and duties of the various branches; (*c*) Operations.

The opening chapter of Part I. lays down that the supreme Commander-in-Chief decides on the nature of the operations to be undertaken against a fortress. If this blocks the communications of the field army, if it contains resources the loss of which would vitally injure the enemy, or if its military or political importance is such that its fall would have a great moral effect, then it should be attacked. Otherwise it can be masked or invested. In discussing the various methods of attacking a fortress the Regulations state that a bombardment should not take place until the regular supply of ammunition is assured.

The commander of a besieging army has the status of a general commanding an independent army. His Chief of the Staff not only superintends the Staff but is responsible for the telegraphic, aeronautical and topographical services. The artillery is under the control of the artillery commandant and is grouped in the "front of attack." The artillery commandant is directly responsible for such narrow gauge railways and telegraph lines as are necessary for the working of the batteries. On the other hand, the Engineers, although under the technical control of the C.R.E., are allotted to the various sections of investment. As soon as the attack is in touch with the principal line of defence of the fortress the Engineer commandant of each section of the front of attack details a field officer who acts as an intermediary between the Engineers and the troops furnishing working parties.

The chapter on siege operations gives regulations for the investment, the driving in of the enemy's advanced troops, the selection of the "front of attack," the scheme of attack, the construction of the siege batteries and the protective infantry line, the advance by sap and mine, and finally the assault. The besieging batteries are to open fire simultaneously and when all preparations have been made for the regular supply of ammunition.

Part II. opens with a description of the duties of the governor of a fortress on the outbreak of war and approach of the enemy. The principles of defence are laid down and special attention is drawn to the necessity for offensive operations and the preparation of advanced positions, which should, however, be within the range of the heavy guns of the principal line of defence. The organization of the defending army is based on the

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necessity of having :—(*a*) Garrisons for the outer sections or sectors ; these troops are responsible for the defence of the various advanced positions ; (*b*) Garrisons of the *points d'appui* of the line of forts ; (*c*) Garrison of the fortress proper ; (*d*) General reserves.

As soon as the enemy's "front of attack" has been opened, the governor nominates a commander of the zone of attack (*terrain des attaques*). The duties of each arm are much the same as those laid down in Part I. for the Attack. It is distinctly ordered that an ascent of a free balloon is only to take place by the governor's order.

The operations of the defence comprise the defence of the advanced positions, which must not be held too obstinately, the organization of the principal line of defence (consisting of forts, batteries for heavy guns, and infantry trenches), rallying positions in rear of the main line, which are to be made as soon as the enemy's "front of attack" is known, and the defence of the centre of the fortress. The artillery may be divided into two categories, viz. :—that which is completely defiladed and that which is only partially defiladed. In addition, there are the mobile and reinforcing artillery, the latter being principally obtained from that part of the line not directly attacked. Finally, instructions are given for the protection of a town or place against bombardment.

HISTORICAL.

FIFTY YEARS OF NEW JAPAN. By Count Okuma. Two vols. 1,242 pp. 8vo. London, 1909. Smith, Elder & Co. 25s.

These volumes are intended to serve as a record of the progress made by Japan in various directions during the fifty years 1854—1904. The various sections of the history have been prepared by well-known men, specially qualified to write on their particular subjects, as they have in many cases taken an active part in the development of the country. For instance, the history of the army is the work of Field Marshal Prince Yamagata, while that of the navy has been written by Admiral Count Yamamoto. There are fifty-six chapters in all, dealing with every branch of the national development, whether military, commercial, educational or religious. In every case a brief *résumé* of events since the earliest times is given, and in some chapters this *résumé* is not the least interesting part. There is an excellent large scale map of Japan.

Although the point of view throughout is exclusively Japanese, the volumes contain a quantity of useful information and form a valuable work of reference.

THE WAR OF 1870—1871. THE INVESTMENT OF PARIS. II. CHÂTILLON (La Guerre de 1870–71. L'investissement de Paris. II. Châtillon). By the Historical Section of the General Staff of the French Army. Text 534 pp. 8vo. Appendix of documents, 406 pp. 12 maps, in separate cover. Paris, 1909. Chapelot. 16s.

This is Volume II. of the Section of the French official account of the war of 1870—1871 dealing with the Siege of Paris. Volume I., "The Organization of the Fortress," appeared in 1908 and was reviewed on page 63 of No. 9, R.P.M.I. ; April, 1909.

This instalment contains two sections : the "Guarding and Destruction of the Communications" and the "March of the German Armies from Sedan on Paris" ; it concludes with the action of Châtillon on the 19th September, 1870.

AUTOBIOGRAPHY OF SIR HARRY SMITH—1787–1819. Edited by G. C. Moore Smith, M.A. 333 pp. 8vo. Portraits and maps. London, 1910. Murray. 2s. 6d.

This is a cheap edition of a portion of one of the most fascinating of military autobiographies. It contains the period of Sir Harry's life of most interest to soldiers :—The

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Peninsular War, the Washington Expedition, the New Orleans Expedition, and Waterloo and closes in 1819 when he was a lieutenant-colonel, and the occupation of France after Waterloo came to an end. For those who would follow his career through the Kaffir War of 1815, the War in Gwalior of 1843, the first Sikh War of 1845-6, and his governorship of Cape Colony 1848-52, during which he defeated the Boers in Boomplats, the larger work is still available.

OFFICIAL HISTORY OF THE RUSSO-JAPANESE WAR. Part IV. Liao-Yang. Prepared by the Historical Section of the Committee of Imperial Defence. 120 pp. 8 maps. 8vo. London, 1909. H.M.S.O. 4s.

The fourth part of this work deals with the Battle of Liao-yang, and the events preceding and following it from 23rd August to the 10th September, 1904. On page 7 the immediate defences of the city of Liao-yang are described as "permanent works" and "forts."

This is an error; the works were, in reality, "provisional defences" and consisted exclusively of strong fieldworks.

IMPRESSIONS OF SOME OF THE MANCHURIAN BATTLEFIELDS. Lecture by Lieut.-Colonel W. D. Bird, D.S.O. 15 pp. 8vo. 8 maps. London, 1910. Rees. 6d.

Lieut.-Colonel Bird was one of a party of officers from the Indian Staff College sent on a tour round the Manchurian battlefields in 1907. The lecture gives his impressions and contains some topographical descriptions of the country, which will be found of considerable use by officers studying the campaign.

RUSSO-JAPANESE WAR MONOGRAPHS. Vols. XVI.—XVII. (Einzelschriften über den Russisch-Japanischen Krieg. 16 u. 17 Heft). 110 pp. Table of contents, 6 maps. Two Orders of battle. Five sets of photographs and panorama sketches. 8vo. Vienna, 1909. Seidel. 5s.

This is one of a series of monographs issued as supplements to *Streffleur's Militärische Zeitschrift*. The volume under review describes the actions of Yu-shu Ling and Yang-tzu Ling. The narrative is based chiefly upon the reports of various foreign attachés to whom the authors (Colonel v. Habermann and Capt. Nowak), acknowledge their obligation. The writings of Capt. Swejtschin (*sic*) who fought on the Russian side at Yang-tzu Ling are freely quoted, and reference is also made to von Tettau's book and Kuropatkin's "Report" to the Tzar.

The actual account of the fighting is preceded by character-studies of Generals Keller and Sluchevski, who commanded the two chief groups into which the Russian forces were divided. The orders issued to the troops on the Russian side and their movements before the actions are summarized and discussed. The last twenty-two pages are devoted to criticisms. The appendices include: a general map showing the situation on the 30th July, 1904; three maps showing phases of the fighting at Yu-shu Ling and Pien Ling; two illustrating the fighting at Yang-tzu Ling; orders of battle of Russian and Japanese forces engaged; table of Russian losses; table showing the expenditure of ammunition by the Japanese; sketches and photographs of the country and positions around Ta wan, Pien Ling and in the Hsi Ho valley.

The various episodes of the fight are described in great detail. Especially interesting are the very full account of the fighting and movements of several artillery units, and the graphic story of Keller's death and of the numerous mishaps, misunderstandings and omissions on both sides. The ill-success of the Russians is attributed to:—(1) constant changes of plan, and hesitating attitude in high quarters which affected the *moral* of the troops, (2) want of precautions, (3) lack of unity in command, (4) the holding back of many guns and the premature withdrawal of others that were engaged, (5) the non-employment of a whole (3rd East Siberian Rifle) division. The Japanese plan is

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praised, but its execution is criticized; its chief faults are alleged to have been:—Employment of too many troops to guard flanks and communications, slow movements of troops, lack of co-operation by some commanders, unduly wide extensions, half-hearted attacks. The transliteration, which differs from ours, must prove a stumbling-block to British readers. In some cases the nomenclature differs, *e.g.* the Fu-chia Shan of our official history is termed Makurayama, General Gerschelmann is called Herschelmann, etc. The maps of the battles are a little confused owing to the great detail in which movements and positions of small units are shown. Despite this the book is full of interest and instruction.

A SHORT HISTORY OF THE CHIEF CAMPAIGNS IN EUROPE SINCE 1792. By General A. von Horsetzky. Translated by Lieut. K. B. Ferguson. 493 pp., with index, 6 maps and numerous sketches. 8vo. London, 1909. Murray. 18s.

This translation is an abridgment of the Austrian original, but the utility of the work as a manual of military history does not appear to be affected thereby.

In the first chapter the translator has summarized the author's introduction, his remarks on tactics, organization, armanent, etc., at successive stages in the development of military science, and his concluding remarks.

The remaining chapters consist of short summaries of the various campaigns in Europe, up to and including the Graeco-Turkish War of 1897, arranged in chronological order. The main facts of each campaign are given, but no remarks or comments are offered.

The original German version contains 38 large maps, which are replaced in the present abridged translation by 6 maps and numerous sketches.

GERMAN EAST AFRICA IN REBELLION DURING 1905–06 (Deutsch-Ostafrika im Aufstand, 1905-06). By Graf von Götzen. 274 pp., with 6 coloured illustrations and 5 maps. Berlin, 1909. Dietrich Reimer. 12s.

This book is of special interest as the author was Governor of the Protectorate in 1905.

It will be remembered that on the 7th August, 1905, a native rising commenced in the Matumbi Mountains, north of Kilva-Kivinje, between the rivers Rufiyi and Mandandu. This rising spread gradually, involving the districts in the centre, south, south-west and on the coast as far north as the district of Dar-es-salaam. In numerous small engagements the Protectorate troops were everywhere successful, but reinforcements were found necessary, and marines were sent from Germany for the purpose. Early in 1906 the rising was officially announced as at an end.

The book gives an interesting account of the native tribes and their manners and customs. A detailed account of the military operations follows; the conclusion is arrived at by the author that a stronger garrison is required than existed at the period in question.

A HISTORY OF MALTA, DURING THE PERIOD OF THE FRENCH AND BRITISH OCCUPATIONS, 1798—1815. By William Hardman. 648 pp., with an index and two illustrations. 4to. London, 1909. Longmans, Green & Co. 21s.

This interesting and valuable history of Malta is due to the zeal of the late Mr. Hardman of Valetta. The sole object of his deep research and infinite labour "has been to learn the truth" for those interested in the events of the years 1798—1815, as far as they concern Malta's relation to the British Empire.

Mr. Hardman died before his material was prepared for the Press, and the work was, at the request of his executors, edited by Dr. Holland Rose, by whom an exhaustive introduction has been written.

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The history contains exhaustive accounts of the attack and capture of Malta by the French, and of the French Government of the Island. The British blockade leading up to the capture of Valetta forms the subject of six chapters. In the 21st and 22nd chapters will be found interesting discussions and correspondence relating to Malta, which show in correct perspective the place and influence of the Island in the war waged by Great Britain between the years 1803—1815.

THE LIFE AND LETTERS OF JAMES WOLFE. By Willson. 511 pp., with illustrations and index. 8vo. London, 1909. Heinemann. 18s.

A considerable number of biographies of Wolfe have already been published, but the present volume cannot fail to take its place amongst standard works on the subject, in view of the number of his letters it contains which have not hitherto been published. Some of them might have been omitted without detracting from the clear impression of the hero which the book enables the reader to form, but nevertheless little fault can be found with it on this account owing to the admirable manner in which it has been put together.

The life of Wolfe is closely followed from his earliest infancy up to the day of his death at the early age of thirty-three. Being an indefatigable letter writer, the perusal of his numerous letters gives a good insight into his somewhat complex character, and this is further elucidated by information derived by the author from other sources.

The story of the taking of Quebec is clearly and succinctly told and forms by no means the least interesting part, from a military point of view, of an interesting book.

SOUVENIRS AND OBSERVATIONS OF THE CAMPAIGN IN 1870 (Souvenirs et observations sur la guerre de 1870). By General Devaureix. 740 pp., with 3 maps. 8vo. Paris, 1909. Charles Lavauzelle. 6s.

The author, at the time of the war a subaltern in the line, has been enabled, owing to the fact that he kept a diary, to give in this interesting volume a realistic and absorbing account of the early part of the campaign in which he took part. Taken prisoner at Metz, he was able to amplify during his captivity his daily notes, and in reading the souvenirs thus noted down while still fresh in the author's memory, vivid pictures are evoked of the numerous battles and engagements in which he took part.

There are also many valuable criticisms, emphasized by accounts of the faults committed, which render the volume worthy of close attention from a purely military point of view. Like all those taken prisoner at Metz, the General bitterly criticizes Marshal Bazaine.

The author also took part in the recapture of Paris by the regular troops from the Communists, and his description, also based on a diary, throws an interesting light on the various phases of the civil war, the more interesting because no account of the Commune has yet been written by an officer who took part in the second investment of Paris.

ORGANIZATION AND ADMINISTRATION.

THE GARDE MOBILE OF 1870 (La Garde Nationale Mobile de 1870). By L. Thiriaux. 252 pp. Small 8vo. Brussels, 1909. L'Expansion Belge. 2s. 1d.

The author, who is aide-de-camp to the Commander of the Garde Civique of Brussels, describes his work as a contribution to the study of improvised armies. His object in writing it is that his countrymen in their choice of a defensive force may have the benefit of the sad experience which France suffered 40 years ago. The narrative is founded entirely

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on official and historical records, to which reference is given in footnotes, and forms a most useful and valuable summary.

From 1815 up to 1866 public opinion in France as regards the army was crystallized in the following sentence :—"The army is only necessary for the maintenance of order and the established power, and for expeditions beyond the seas : as regards the defence of the country, the nation suffices ; a Frenchman is a born soldier, and when the country is threatened, everyone will take his rifle from the wall like his ancestors in 1792."

Of course military officers, and notably Marshal Niel, the War Minister, did not share this illusion, but it was so strong that even after the success of Prussia against Austria in 1866 the Marshal did not dare attack it directly and demand universal service. In March, 1867, he proposed, as a half measure, a "garde mobile," which should consist of men who would receive the training of reservists of the regular army and then be liable for service for five years. It was expected to provide about 500,000 men.

M. Thiriaux traces the course of the Bill in Parliament. "The opposition to it was terrible," and only paper schemes emerged from the conflict. "The law refused training to the gardes mobiles, the Budget refused them clothing and arms" ; power was only given to enrol the cadres on paper, and even this was only done in certain departments.

When the call to arms came in July, 1870, except for 20 battalions and 35 batteries, a total of 40,000, organized in the eastern fortresses, "the mobilization was a creation pure and simple." For the thousands called out there were no arms (except 30,000 "chasse-pots" at Strasburg), no clothing, no equipment, no transport ; all had to be purchased or improvised for 400,000 men. "Training was carried on with fury ; certain battalions had as much as nine hours drill a day." It is pointed out that lack of uniform resulted in many "gardes mobiles," who were captured by the Germans, being shot as marauders not entitled to the rights of combatants.

A certain amount of order had been instituted when, on the 19th September, the Government of National Defence revoked the commissions of all the officers and ordered the units to proceed, as right and proper in a republic, to the election of others, "même sous le feu d'ennemi." Some battalions, notably those of the West, "wiser than their great leaders," renominated their officers ; but others, notably those of the Seine, elected, in order to have an easy time, "the adversaries of all discipline and confirmed drunkards." The "mobiles" were then placed on the same footing, as regards pay, promotion, etc., as the regular army, and "the suppression of permanent armies was advocated by the men in power."

"Some officers who had not been re-elected for the reason that they took the service seriously were appointed sergeants-major."

The military value of the "mobiles" is investigated by the author in sections dealing with the Siege of Paris, the war in the provinces until December, the winter campaign and the sieges. Nearly every action of importance is dealt with separately, and reveals nothing but failure.

The conclusions of the author are, "as a consequence of the improvidence of the Chamber and of the Ministry, not only was there nothing ready, but the belated effort required of the 'mobiles' was useless and cost an enormous amount. The contracts made for their clothing and armament were ruinous, but nevertheless the men underwent unheard-of sufferings during the rigorous winter of 1870."

"It may be regarded as a principle, that henceforward no useful effect in war can be expected except from forces which have been minutely prepared during peace."

Such units as distinguished themselves were found to have had sufficient retired regular officers and non-commissioned officers to commence instruction and provide experience. In many cases these trained men were too old to stand the strain of a campaign for more than a few weeks, but the good work they did remained, for "nothing can replace ex-officers, because they are professionals."

"The fact alone that they were, or imagined they were, armed with an inferior weapon, had a disastrous effect on *moral*, and affected some battalions for the whole of the campaign."

An appendix gives the original Bill of March, 1867, the counter-project of the Parliamentary Committee and the law of February, 1868.

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POLITICAL.

THE VALOUR OF IGNORANCE. By Homer Lea. 344 pp., with portrait and map. 8vo. New York, 1909. Harper. 7s. 6d.

This work deals with world forces and the very humble part the United States are destined to play amongst them, if they do not quickly awaken to a sense of their present state of military helplessness. The book is divided into two parts, the first of which is in the nature of a philosophical study of the causes which lead to the rise and fall of nations. The author in this part devotes himself to showing that national greatness is inseparable from military progress, and that, where wealth and luxury are allowed to sap the military strength of a people, the time for its downfall draws near. The second part is the application of these ideas to the concrete case of war between the United States and Japan for the mastery of the Pacific.

Some of the language employed may appear somewhat extravagant; but, in spite of this, the book is one which it would be well for every Englishman to read; he can then consider to what extent the warning here conveyed to the United States might not equally well be addressed to his own country.

It has been stated in some periodicals that the author is a general; this is not the case, he has never served in the Army or militia.

TRAINING AND EDUCATION.

ARE WE READY FOR WAR? (Sind wir kriegsfertig?) By Major Hoppenstedt. 234 pp. 8vo. Berlin, 1910. Mittler. 4s.

In this work the well-known author discusses various military questions in the form of a diary. The opening pages are devoted to a consideration of the use of military studies in general, and of military history in particular. Napoleon's words, that in studying campaigns the why and the wherefore must be sought for, are quoted. Warnings are uttered against superficial study of campaigns, generalizing from single events, and disregarding factors such as surprises, outside influences, personal relations, etc. Passing on to the Jena Campaign, which is discussed "from the Mene Tekel standpoint," the author gives its tactical and strategical outlines, quotes from narratives of participants, and adds extracts from various documents to illustrate the lamentable state of the Prussian Army on the eve of the campaign. The regeneration period of Prussia's forces, between 1807 and 1813, is examined by allusions to the three leading personalities, Gneisenau, Yorck, and Scharnhorst, whose writings are quoted. The main tactical and strategical features of the wars of 1813—1815 are discussed and criticized. Commenting on a correspondence between Blücher and Yorck, in which the latter is blamed by Blücher for slowness in pursuit, the author points out that defective orders were partly responsible, and adds, "even the projects of genius do not produce successful results without schooling and experience (of staffs)." A description of the pursuit after Waterloo is followed by a discussion of Blücher's career and character. Reflections follow on Napoleonic methods of warfare and on the operations of modern "mass-armies." The author quotes a saying that every officer should have an insight into the complicated mechanism of big armies, and adds that this requires careful study of military history combined with power of imagination. He reproduces in outline, and discusses a study by General von Falkenhausen dealing with the strategic deployment and initial action of mass-armies facing each other on the Franco-German frontier. Noteworthy is the conclusion that mountainous country is ill-suited to enveloping tactics of large bodies of troops, as they (especially the artillery) cannot make their influence felt. The opinion expressed by the author, that a war of revenge offers no prospects of success for France, is also of considerable interest. "Mass-armies" in general are held to necessitate a return to "rougher" tactical methods, owing to want of deploying space and difficulties of subsistence. Regarding marches the author estimates a loss of from 8 to 12 per cent. due to

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falling out at the outset of a campaign. To prevent this he proposes: removal of boots during railway journeys; doubling drill at halting places; massage; preliminary enquiries into marching capacities of reservists (bad marchers to be relegated to fortress troops) and occasional severe tests in peace time. The depth of marching columns must, he maintains, be diminished; reconnoitrers must report when troops can march off the roads; advanced parties must prepare and indicate routes for advances on broad fronts, and mark crossings over water, etc.

Examples are given to show the capabilities of close billets. The following is worthy of note:—"What about the inhabitants?" he asks. "There must be no nonsense about humane dealing where so much is at stake; the smallest space must suffice for them." Of subsistence he says: "Two grand inventions are field kitchens and motor vehicles; 550 motors with 2,200 men now accomplish what 4,050 vehicles and 4,900 men did before."

Succeeding pages are devoted to physical fitness, the Prussian parade step, manual exercises, garrison duties, saluting, and theoretical instruction of soldiers. The author considers guard duties of value as awakening a sense of responsibility. The influence of strict ceremonial drill on *moral* is happily illustrated. The remarks on individual bayonet fighting contain a warning against undue vigour in the assault entailing a loss of control. After a plea for more variety in garrison training grounds, wood fighting is considered, and examples are given and extracts quoted from the writings of an officer who fought at Wörth. The author quotes and endorses the opinion of several well-known writers, that colours should accompany a unit into the field and be placed well forward in action. He advocates practice in the rapid assembly of improvised units, instead of marching complete units on markers.

Other sections deal with the Russo-Japanese War, co-operation of the three arms and night operations. (Instructions issued by Sir J. French regarding the last named are quoted verbatim). The author suggests that at field exercises, on a signal from the directing authority or by order of an umpire, a flag should be hoisted on a position to indicate that it is under artillery fire; further, that some indication regarding the nature of the (imaginary) projectile used and the tactical situation of the artillery should be given where possible. A picture illustrates entrenching by skirmishers during an attack. The use by attacking infantry of sandbags (*a*) as screens from view, (*b*) as cover from fire, is also discussed. The author advocates constant practice for infantry in destroying wire entanglements.

A passage dealing with "Training for action" pleads for practice in fighting at close ranges, greater depth (*i.e.*, smaller frontages) at peace manœuvres and training of officers and non-commissioned officers in close reconnaissance.

STRATEGICAL AND TACTICAL.

INDIA IN IMPERIAL DEFENCE. A Lecture by Capt. D. I. Macaulay. 23 pp. 8vo. London, 1910. Central Asian Society.

The lecturer begins his subject by a survey of Indian military policy with regard to the great Asiatic Powers. These comprise Russia, Afghanistan, China, Persia, Turkey and Japan, and the peculiar circumstances of each and the manner in which these act and react upon one another are succinctly described and discussed.

Attention is drawn to the influence on Indian defence exerted by the rise of the German Navy combined with the disappearance of Russian naval forces from the Pacific, and the lecturer proceeds to take a wide and comprehensive view of the entire naval situation in the East.

Upon the deductions drawn from this survey he bases his recommendations as to the policy best calculated to safeguard British interests in Asia.

Briefly stated, Capt. Macaulay's proposals are:—(1) India should assume complete responsibility for the defence of Colombo and Singapore. (2) The East India and China squadrons should be definitely incorporated as one fleet. (3) Port Darwin should be fortified and made an alternative base of Sydney for the Australian fleet unit so as to

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bring the latter into touch with the Singapore system. (4) India should take over the maintenance of the East India and China fleet units. (5) The self-governing parts of the Empire should consider the question of constructing at least four *Dreadnought* battleships to be eventually handed over to the Indian fleet: and (6) the expenditure for this purpose should be met by a loan, the sinking fund and interest charges to be met by the self-governing nations on a fixed basis

The lecturer concludes with a criticism of the results attained by the Defence Conference of 1909.

TACTICAL EXERCISES WITH SOLUTIONS (Thèmes Tactiques). By Lieut.-Colonel Egli, of the General Staff of the Swiss Army. Translated from the German by Major Morier, Military Attaché to the French Embassy in Switzerland. 143 pp., 2 maps. 8vo. Paris, 1909. Chapelot. 2s. 6d.

This French translation renders available the first collection of tactical problems published by a Swiss officer to a large circle of British readers. The book is of special interest, as it gives the ideas of an officer who for many years has been one of the staff of permanent instructors of a Militia Army. The orders will be found considerably longer and more detailed than those usually issued in the great continental armies. The fact that the subordinate commanders in the Swiss Army are only able to give a comparatively small portion of their time to military study and training is probably accountable for the necessity of issuing orders in considerable detail.

During the latter phases of the Franco-Prussian War of 1870 the same difficulty as regards the avoidance of detail in orders was experienced by General Chanzy. He found that it was impracticable, when dealing with the *mobiles*, to issue orders in the same brief and succinct form which can be adopted in the case of highly trained staffs and regular troops.

THE REALITY OF WAR. By Major S. L. Murray. 118 pp. 8vo. London, 1909. Rees. 2s. 6d.

This book is written with the two-fold object of inducing the readers of it to study the writings of Clausewitz and to give those who are too busy to study the original writings some notion of that author's leading ideas on policy and war. It commences with a short account of the life of Clausewitz with the object of showing what exceptional opportunities he had during the wars of 1793—1815 of studying in the field the methods adopted by the great commanders of that period, and of developing in a practical manner the theories he formed as a result of these experiences.

It then proceeds to show how the influence of the writings of Clausewitz has been steadily growing, and now may be said to permeate modern military and political thought in every nation with the exception of Great Britain, notwithstanding the fact that "it is admirably adapted to form a main stem in the military culture of British officers."

Major Murray next selects a few of the leading ideas from Clausewitz "On War," and concentrates his attention on impressing the soundness of them on his readers by means of numerous quotations from the original and from later authoritative writers.

Amongst the subjects selected are "Theory and Practice in War," "Public Opinion in War," "The Nature of War," and "Strategy," and these are briefly and ably dealt with from a political and military point of view.

Throughout the book Major Murray insists on the necessity of both statesmen and soldiers studying the famous work of Clausewitz "On War."

NIGHT COMBATS AND NIGHT MANŒUVRES (Nacht Gefechte und Nacht Übungen). By Lieut.-Colonel Balck, German Infantry. 302 pp., with 22 diagrams in text and 3 appendices. 8vo. Berlin, 1910. Eisenschmidt. 8s.

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The book commences with a historical review of night operations with descriptions of some typical instances prior to the Russo-Japanese War, and a summary of the regulations of the British and other Armies on the subject. The war in Manchuria, 1904–5, is next dealt with. The opinions of the Russian and Japanese staffs are stated to be as follows:—"General Kuropatkin holds that the best means of meeting night attacks is to keep the troops nearest to the enemy fresh by frequently relieving them. He is averse from night attacks on the large scale. On the other side, the Japanese Staff lay down that the advance is to be continued systematically by day and night, entrenching the ground gained, till on the third night the infantry arrive within 300 or 400 yards of the position. Three or four sham attacks are to be made, and the real night attack is then to be delivered."

The third portion of the book deals with night operations in field and fortress warfare, with historical examples. Colonel Balck pleads for the more careful training of troops in night work; his views on this subject are briefly as follows:—

"Nowadays night training is no less necessary than day training.

"In Japan, since the war, night manœuvres have been constantly carried out. The Japanese recruits go through a 12 weeks' course of training, of which the last fortnight is devoted to night work.

"Night manœuvres must be carried out on dark nights and under a full moon, in summer and when the ground is covered with snow.

"Attention must be devoted to maintaining direction by the stars. Little time should be devoted to individual instruction, and manœuvres with formed bodies should be commenced as early as possible, first by companies and then by battalions and brigades. Particular attention is to be devoted to night outposts, sentries, and patrols.

"Night rides should be carried out, preferably in the dark winter months. In these, troops must be posted to represent the enemy. Maps for these rides must be specially prepared, the route being marked by a broad black line. Wind-proof matches are to be used for reading maps.

"The winter campaign of 1807 forms a good basis for night schemes.

"If two opponents meet, and one is thoroughly trained in night work while the other is not, the first will have an immense advantage."

The work is written with Colonel Balck's usual clearness and directness.

THE TACTICS OF THE THREE ARMS (La Tattica delle Tre Armi). By Capt. Luigi Giannitrapani. 165 pp. 8vo. Rome, 1910. Voghera. 2s. 6d.

This book is a reprint of a number of articles which appeared in the *Rivista d'Artiglieria e Genio*. Their object is to show how the tactics of the future are likely to be affected by the lessons of recent campaigns. A brief historical retrospect is first made of the chief lessons of the Franco-Prussian, Russo-Turkish, and Anglo-Boer Campaigns. The Russo-Japanese Campaign is then treated in considerable detail, the questions of machine guns, of heavy artillery, and of quick-firing field guns being especially considered. In the second part the author devotes 50 pages to the probable tactics of the future.

In the first portion of the book, which is chiefly devoted to minor tactics, there is nothing remarkably new, but the deductions from the wars in South Africa and Manchuria are very clear and well arranged, while there are ten interesting pages on the different methods of employing Q.F. artillery in France and Germany respectively.

The author emphasizes the fact that many of the incidents in recent campaigns were due to abnormal local conditions, which would be impossible in a war on the continent of Europe. He then proceeds to describe the various phases of an action in the next "normal" war. The following are some of the more interesting conclusions arrived at:—(*a*) The great principles of tactics remain unchanged, but it is doubtful if the pure offensive still maintains its superiority over the defensive-offensive. (*b*) In the attack, successive waves of infantry only increase the depth of the target without increasing the fire power of the infantry; consequently, supports should not be employed, but two out of the three battalions in a regiment should be deployed as a firing line, the third (reserve)

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battalion being sent forward between 1,000 and 400 yards from the point of assault. (*c*) Actions will be slower, and the fronts occupied will tend to increase in the future. (*d*) All units have now an increased reserve of destructive power; they can utilize this to repel attack or counter-attack, consequently it will be unnecessary to lock up so many troops in local reserve, and in future these may be employed in the decisive attack.

No mention is made of the method of employing a general reserve or of delivering a decisive counter-attack.

TRAVEL AND TOPOGRAPHY.

A GERMAN STAFF OFFICER IN INDIA. By Count Hans von Koenigsmarck. 340 pp., with numerous illustrations and an index. 8vo. London, 1910. Kegan Paul, Trench, Trübner & Co., Ltd. 10s. 6d.

The translation of the book, which originally appeared in German, contains a series o vigorously drawn word-pictures of the various places visited by the author. The scenes depicted include many of the most characteristic spots of India, and convey a realistic idea of the country and the manners and customs of the population, official and non-official. To the military reader the author's impressions of the north-west frontier, the British and Indian soldier, and the life led by the Anglo-Indian official in India, will be of most interest. Without any pretensions to being a book of reference with regard to the subjects dealt with, the volume contains a considerable amount of useful information conveyed in an attractive form. The attitude of the author throughout the book is that of an enthusiastic admirer and, at the same time, an intelligent critic of the work undertaken by Great Britain in India.

TO ABYSSINIA THROUGH AN UNKNOWN LAND. By Capt. C. H. Stigand, F.R.G.S., F.Z.S., Royal West Kent Regiment. 346 pp., with illustrations and 2 maps. 8vo. London, 1910. Seeley & Co. 16s.

Capt. Stigand in this book gives an account of a journey through British East Africa to Lake Rudolph, and thence to Addis Abbaba, the capital of Menelik's kingdom.

Leaving the Uganda rail at Gilgil, the expedition marched to Rumuruti, on the edge of the Laikipia Plain country, where the administrated part of British East African territory was left. A route due north was then taken to Rendile, thence N.E., skirting the Boran country and back west to Lake Rudolph. This portion of the journey, through tracts of our territory but little known, occupies the first half of the book.

As regards the second portion of his journey, *i.e.*, from Lake Rudolph to Addis Abbaba, Capt. Stigand's route lay to a great extent through the country east of Lakes Margherita and Zwai, surveyed in the same year by Major Gwynn's Anglo-Abyssinian Boundary Commission on its return from demarcating the southern boundary. Capt. Stigand's remarks, added to Major Gwynn's work, add very considerably to our knowledge of the localities in question. The remarks and observations on the methods of Abyssinian administration are interesting, and the establishment of telephonic communication in Abyssinia, as far south as Dalbo, is noteworthy.

ZAMBEZIA. By R. C. F. Maugham, British Consul for Portuguese East Africa. 408 pp., with 1 map and numerous photographs. 8vo. London, 1910. John Murray. 16s.

This book forms a companion volume to the author's *Portuguese East Africa*. Mr. Maugham, who has been fifteen years in the country, has not only acquired a knowledge of it that is encyclopædic, but has the power of imparting that knowledge in a most readable form. The country described is that of the Zambezi valley from the sea to the

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town of Tete. Its history, past and present systems of administration, commercial possibilities, flora and zoology, are in turn described, while three most interesting chapters are devoted to an account of the customs and characteristics of the native tribes.

Emphasis is laid on the great agricultural potentialities of the country, the slowness of its progress being attributed to: (*a*) the existence of under-capitalized land companies who take up more land than it is possible for them to develop; (*b*) the lack of communications: almost the only means of communication is by the uncertain and shallow waters of the Zambezi; roads and railways are practically non-existent; (*c*) the difficulties of the native labour question.

The present-day Portuguese officials are reported to be of a more energetic and resourceful type than their predecessors, and Mr. Maugham considers that if they are given support the country has a great future.

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Note.

The only route from Hartebow to Nankin that is capable of being used for masses of troops is that leading through Harewood, Wilsberg, Sandbow, Woodcote, Hardcastle, Austin to Nankin.

Capture of Wilsberg will cut this route, open the Turbo line to steamers, and can go to Wessex from the East as well as West. Capture of Woodcote completes circle around Southdown.

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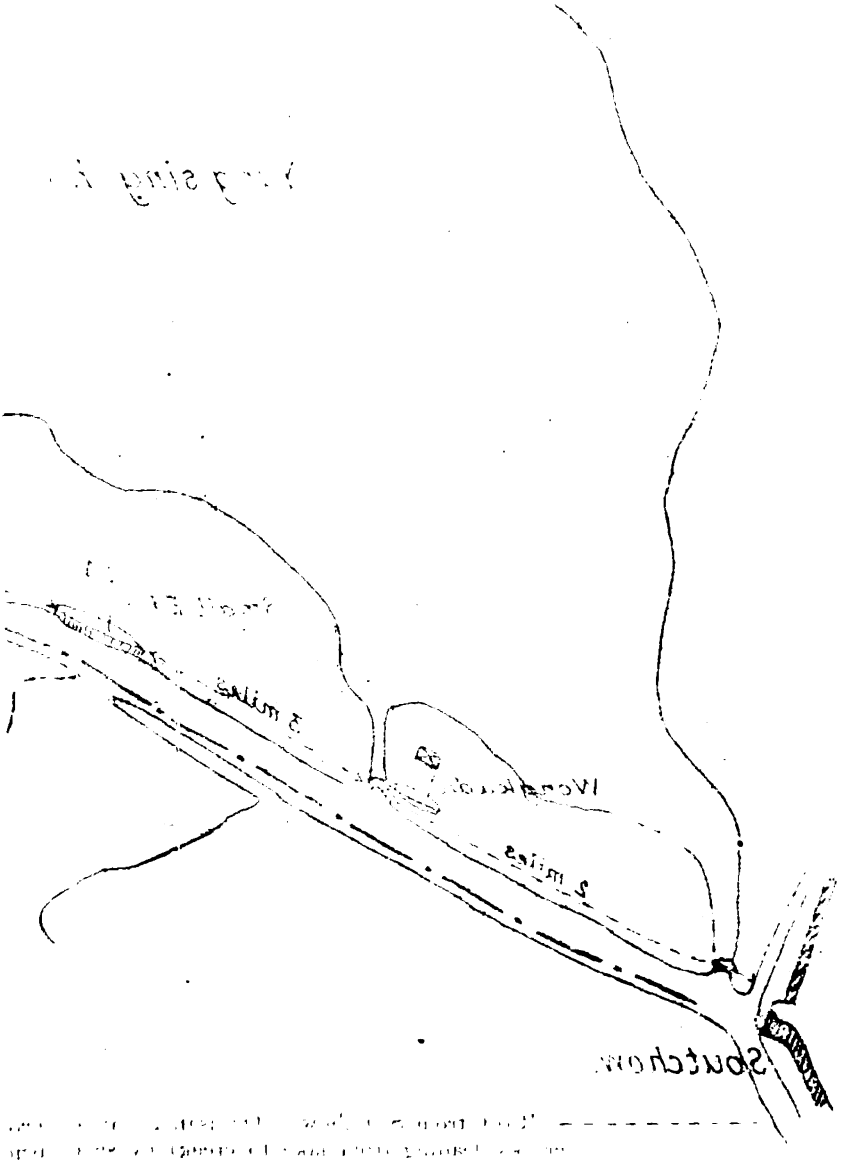

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